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Comparative Analysis of Smart Cities Using Population Changes in EU and India

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Abstract

'A theatre of social drama' very artistically and intelligently a term 'City' has been defined by Lewis Mumford in 1937. As per the definition we can think that how the complex structure of any city is. Universally there is no such definition which can define a city spatially and demographically. Hence the dynamics of the definitions is very important for interpreting the concept of city in any country. The urbanization trend shows great increase at global level and the need to build the new and planned cities which can accommodate people with full of its limits and promote quality of life is gaining importance. The focus of this paper is on smart cities and their different background at global level. This paper discusses the overall pace of urbanization in EU and India using population as one of the driving force for that, while evaluating historical background of cities in EU and India and also analyzes the intimacy between urbanization and evolution of the concept of smart cities.

Introduction

The concept of smart city doesn't have universal definition, where, it changes according to the region, society and by the needs of its inhabitants. Smart city can be defined in various ways by Researchers, Planners, Industrialists etc. It is simply the state of achieving fulfilment in the basic needs of city and its people while simultaneously transforming the society from traditional to modern stage. There are different views that illustrates the concept of Smart

city. In modern world smart cities are more precisely considered as sustainable city which enables its people to meet their needs and not lead to compromise the needs of future generations. To achieve this sustainability, the physical infrastructure of the city plays a vital role. For instance, this physical infrastructure encompasses Hospitals, Transport, Sanitation and Waste Management etc. which ultimately acts as the respiratory system of the smart city. As urbanization has increasing to the faster pace at global level, sustainable development challenges will be increasingly concentrated in cities, particularly in the lower-middle-income countries where the pace of urbanization is fastest. Integrated and optimistic policies are needed to improve the lives of both urban and rural people. Smart cities are diverse around the world in terms of their characteristics, requirements, and components. It has been seen that the developed countries are now mainly focusing the ICTs or improvement of ICT services as to utilize the information for a sustainable way of life.

In the last decades world population has increased significantly simultaneously with an increased expectations of living standards. At the Global level, overall pace of urbanization has been faster than ever before in recent years. Fifty-four per cent of the global population lived in urban areas in 2014 as against 30 per cent in 1950, and it estimated to reach 66 percent by 2050. Close to half of the world's urban dwellers reside in relatively small settlements

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of less than 500,000 inhabitants, while only around one in eight live in the 28 mega-cities with more than 10 million inhabitants. (United Nations, 2014) At present cities consume approximately 75% of the world's resources and energy which leads to the generation of 80% of greenhouse gases. It may lead to severe negative impacts on environment and its resources. This makes the concept of smart city a necessity. The creation of smart cities is a natural strategy to mitigate the problems emerging by rapid urbanization and urban population growth. (Mohanty P. et. al., 2016) Smart cities can not only reduce energy consumption, water consumption, carbon emissions, transportation requirements, and city waste but it can also improve the living standards of its inhabitants.

Urban centres grew up in as a necessary consequence (Fleure, 1920). Cities doesn't evolve in itself or all of sudden and have not always been designed only as small towns and semi-rural areas. Cities are complex phenomenon which has been developed through a long history that we can see the imprints of past human culture, art and socio-demographic transition through the distinct characteristics of each city.

Scenario of Urbanization in Europe

The growth and development of cities in each system follows a distinctive pattern. European cities has been evolved through different phases of history. The Early-Modern Period (1500-1800) the era of absolutism and European expansion was marked by relatively modest changes in overall urbanization, and indeed in population. In terms of the long-term changes in European urban systems, network system is behind most structural transformations, as the cities in Europe are induced by infrastructure in a series of network. Political changes have given rise to new capitals, towns and cities and more rarely demoted others, most notably in the period of absolute monarchy (early modern

times), also in later eras of nationalism and break-up of empires, including most recently the Soviet.

A milestone towards planned city had seen in Europe; In early nineties, The Garden-City plan designed by Howard in Europe where the city limited the number of inhabitants to only 32,000 people, had a central public garden surrounded by impressive public institutions, included fields for sports and commercial arcades (Howard, 1993cfHohenberg.). At the time of emergence of New Towns it has been seen that many new towns appeared simply as uncontrolled camping around a large new factory. Industry, not urban comfort dictated the shape of the town. Since the late eighteenth century and especially in the nineteenth century, European cities have experienced a period of extreme urbanization, previously unseen in the course of history. The population growth curve which had evolved constantly, having a stable, but moderate value since medieval times, started to rise almost vertically in graphs, marking the beginning of urbanization in modern times. (Andreea, 2013) This uncontrolled rapid urbanization created another series of problems in modern cities. Overcrowding was been felt ever more acutely. Slums were also came into existence with the population of urban poor. New Towns are the result of the forceful application of a state policy expressed by governmental decisions. It has been created on the basis of an established policy concerning the purpose, role, location, and the physical characteristics of new settlements. Implementation measures, funds and management procedures are all crucial elements for the new towns' progress.

The European urbanization phenomenon is associated with higher economic, technological and digital development. European cities have become an important hubs for education, innovation and knowledge-based economies. Digitalization has been fundamental to increase competitiveness.

Smart cities oriented policies in Europe is continuously fostering the technological and sustainable development. The European Union (EU) has dedicated continues efforts to come up with a strategy for achieving 'smart' urban growth for its metropolitan city-regions. The EU has developed a series of programmes under "Europe's Digital Agenda". In 2010, the major focus was on strengthening innovation and investment in ICT services for the purpose of improving public services and quality of life. They are cities built for the citizens' life, and the seeking of private profit has not that unique prominence which makes modern English industrial cities and some other too. (Fleure, 1920) Important capitals of powerful countries were built even in modern times as new towns. Examples of such famous urban planning are Canberra, Brasilia, New Delhi or Chandigarh. Most urban plans developed in the early decades were meant to be constructed on open land. Soviet theoreticians, like Nikolai Miliutin, promoted a series of new town concepts such as the Linear City (devised by Spanish city planner Arthur Soria, in the 19th century), in which industry, residential areas, commercial and recreation areas were arranged in parallel strips, following the course of a river and wind direction (Mathieson, 1969; Pensley, 1998 cf Andreea, 2013). The British have ruled many countries such as India as the result of that their new ideal town model exported into Commonwealth's colonies. Presently there are 28 countries which are part of European Union and the demographic trends in those countries shows strong impact on their societies. According to Eurostat regional yearbook 2010, there were 587 million people inhabited the 27 member states (Croatia joined later in 2013) of the European Union.

Table - 1 shows the total population in EU member countries for the period of 1971 to 2011. Europe ranked third in terms of degree of urbanization where more than 70 percent of population residing in urban area. In nearly all western and south-

western regions of the EU, the overall population has been increased over the period 1971–2011. This is particularly evident in Ireland and in almost all regions of the United Kingdom, Italy, Spain, France, Portugal, including the French overseas departments and the Spanish and Portuguese islands in the Atlantic Ocean. Positive population growth was registered also in Austria, Belgium, Luxembourg and the Netherlands. In opposite to that countries like Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania and Romania shows negative trends in terms of population as well as density. The urban grid of towns and large cities, can today be found in all parts of Europe reflects the past, in that the areas longest urbanized, constituting the urban core of Western Europe, retain the highest density of urban places. With the reduction of central planning and development command, new market-related actors (land owners, enterprises and financial institutions) emerged as important players in urban decision-making. Cities became more independent in determining their spatial and demographic developments. Map: 1.1 depicts the spatial distribution of European cities with the density of persons per square km. Generally, regions that include the capital city of the country are among the most densely populated, as the map shows.

Inner London was by far the most densely populated, but the Russels, Wien, Berlin, Praha, İstanbul, București – Ilfov and Attiki (Greece) regions also have densities above 1000 inhabitants per km². The least densely populated region was Guyane (France). Next, with fewer than 10 inhabitants per km², were regions in Sweden, Finland, Iceland and Norway. By comparison, the European Union has, on average, a population density of 113 inhabitants per km². In most of the north-east, east and part of the south-east of the area made up by the European Union, the candidate and EFTA* countries, the population is decreasing. Geographically-concentrated prosperity differential have fuelled the region's recent and current

migratory and fertility trends and resulted in decelerating city growth and, at times, significant depopulation of smaller cities and rural areas in almost all transition countries. Many Croatian cities, for instance, have significant but quite unutilized advantages with their locations. It is therefore important to look into the advantaged region where the growth of the urbanization and smart cities is possible (UN-Habitat, 2013). The European Commission notes that “Strategies will have to take

into account the diversity of cities: their development paths, their size, their demographic and social contexts, and their cultural and economic assets. Among the various examples from Europe, it will be important to examine the relevance of smart specialisation strategies in those cities or regions which face specific difficulties due to the convergence of demographic, economic and social difficulties.

Table - 1

Sr. No.	Countries	Total Population				
		1971	1981	1991	2001	2011
1	Austria	74,79,030	75,53,326	77,10,882	80,20,946	83,75,164
2	Belgium	96,50,944	98,63,374	99,86,975	102,63,414	110,00,638
3	Bulgaria	85,14,883	88,76,652	86,69,269	81,49,468	73,69,431
4	Croatia	44,21,151	46,01,469	47,82,179	42,95,406	42,89,857
5	Cyprus	6,16,900	5,12,300	5,87,141	6,97,549	8,39,751
6	Czech Republic	98,09,667	102,92,717	103,04,607	102,32,027	104,86,731
7	Denmark	49,50,598	51,23,989	51,46,469	53,49,212	55,60,628
8	Estonia	13,68,511	14,82,247	15,67,749	13,92,720	13,29,660
9	Finland	45,98,336	47,87,778	49,98,478	51,81,115	53,75,276
10	France	510,16,234	540,28,630	568,40,661	592,66,572	630,70,344
11	Germany	780,69,482	783,97,490	797,53,227	822,59,540	802,22,065
12	Greece	88,05,098	97,00,826	102,72,691	108,35,989	111,23,392
13	Hungary	103,53,721	107,12,781	103,73,153	102,00,298	99,85,722
14	Ireland	29,71,200	34,32,800	35,20,977	38,32,783	45,70,881
15	Italy	539,58,400	564,79,285	567,44,119	569,60,692	593,64,690
16	Latvia	23,66,424	25,14,640	26,58,161	23,53,384	20,74,605
17	Lithuania	31,60,437	34,22,210	37,01,968	34,86,998	30,52,588
18	Luxembourg	3,39,841	3,64,850	3,84,400	4,39,000	5,11,840
19	Malta	3,02,800	3,18,028	3,61,908	3,91,415	4,14,989
20	Netherlands	131,19,430	142,08,586	150,10,445	159,87,075	166,55,799
21	Poland	326,58,000	357,34,865	381,83,160	382,53,955	380,62,718
22	Portugal	86,63,252	98,19,054	99,70,441	103,30,774	105,72,721
23	Romania	203,61,192	223,52,635	231,92,274	224,30,457	201,99,059
24	Slovakia	45,39,890	49,96,329	53,10,711	53,78,783	53,92,446
25	Slovenia	17,31,787	19,09,566	19,99,945	19,90,094	20,50,189
26	Spain	340,40,642	376,35,389	388,81,416	406,65,545	466,67,174
27	Sweden	80,81,230	83,17,967	85,90,630	88,82,792	94,15,570
28	United Kingdom	557,80,100	563,43,569	573,38,199	589,99,781	630,22,532

Source: Eurostat

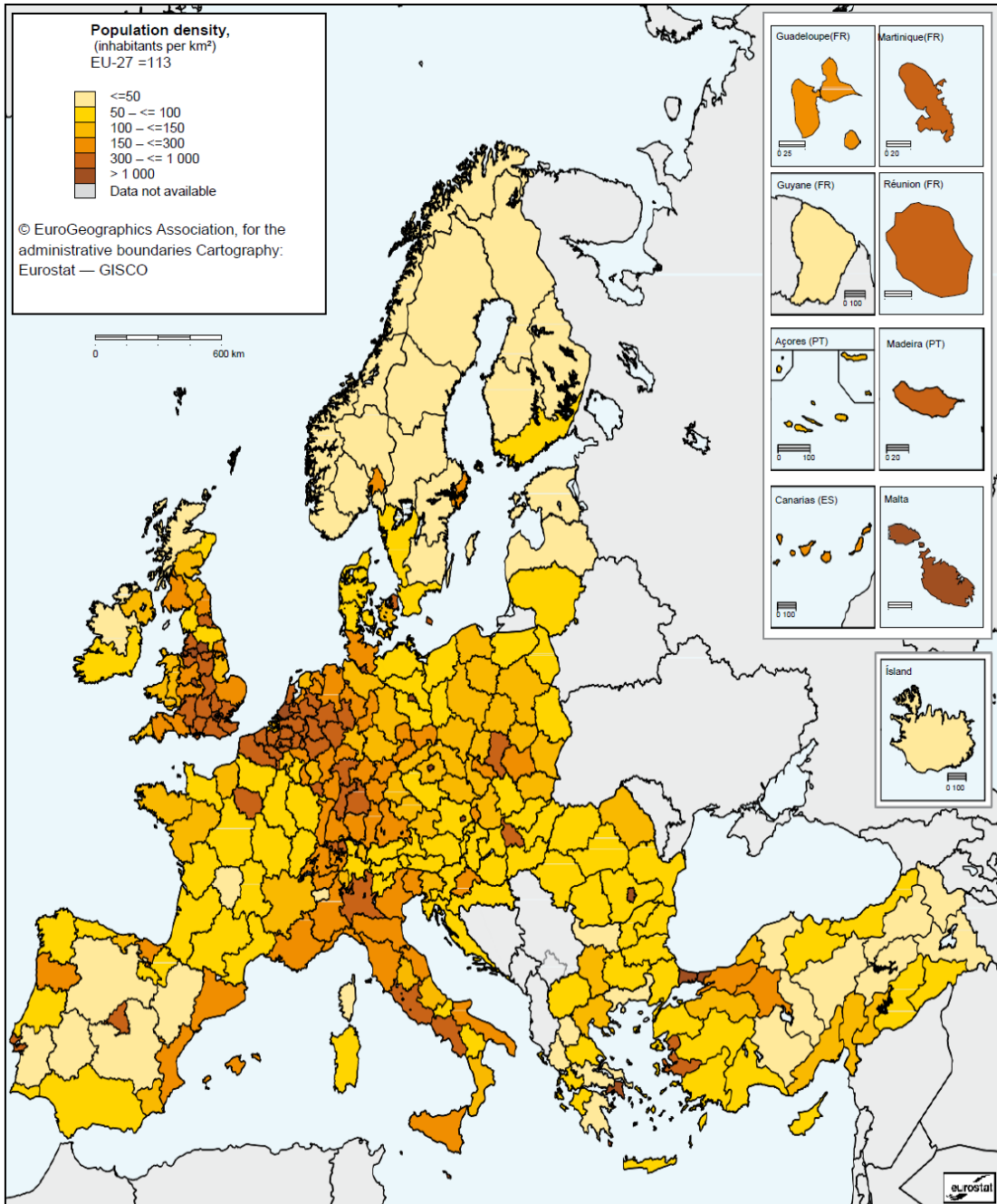


Fig. 1

* Population density is based on the total area of the regions, including inland waters; Croatia and Scotland (UKM), the density is based on land surface, excluding inland waters

Source: Eurostat (tgs00024)

Scenario of Urbanization in India

The urbanization trends in contemporary India is most effectively traced from the colonial period. The transformation of rural areas to urban centres took place in the colonial era as the need of trade were to facilitate the British government for the free and effective trade across the country and to the world. For example, the first railway network was built from Bombay (Now Mumbai) to Thane in 1853 was made available only for the urban elites and not for poor. The cities were planned with a view to providing high-quality civic amenities to the elites linked to the ruling class or those who could afford high prices. Such type of Public facilities were mostly concentrated in the towns and cities and were available only to few privileged sections of the urban community, with access of the rural population being negligible. The growth of towns and large urban agglomeration has fostered near the port or industrial area. Such large sections of urban population were mostly engaged in the import export related activities and so on. Independence brought structural changes in terms of political as well as economic and demographic conditions. The huge increase in population has been seen in India after the independence. This spatial increase in the population has increased demand for urban restructuring and the reflections can be seen through the formulation of policies such as Massive public-sector investment in selected pockets, especially during the Second and Third Five Year Plans (1955–65), helped in restructuring the urban hierarchy. The post independence period in India shows different trends in urbanization and its policy formulation. After the acceptance of LPG policy in 1990s the major emphasis was given on the delivery of basic public services with the focus on large cities. The launching of a 'Mega City' programme for four metro cities and the strengthening of the National Capital Region Plan in the 1990s, with massive central assistance, indicates continuance of this perspective Ninth Plan (1997–2002) and Tenth

Plan (2002–07) put forward a vision of infrastructural development through mobilisation of resources from financial institutions and the private corporate sector with the belief that cities would act as engines of growth. External assistance became a major feature for the agenda to the urban transformation of metropolitan and other Class I cities. The Eleventh Plan postulated planned and balanced urbanization and by promoting small towns and new townships expressed concern regarding the concentration of demographic and economic growth in and around a few cities.

The study carried out by Kundu explains trends and processes of urbanisation in India. The study points out that until sixth five year plan (1980-85) the focus of policy makers have been seen towards overcoming an issues related to basic amenities viz housing, slums, civic amenities etc they did not put forward an approach of urban restructuring or for regional development. No programme was proposed to reflect an urban vision at national or state levels. Unfortunately, the Plan proposed very little in terms of initiatives to address the problems of serious deficiencies in infrastructure and basic amenities in small towns. The interactive system that had previously evolved through the centuries between a large number of handicraft, service and commerce-based towns and their hinterland of primary production, as well as between large cities and smaller towns in the hierarchy, was the major casualty of this process of urbanization. This development dynamics prevailed in colonial period, essentially in response to the requirements of an imperialist regime. Moreover in many developed countries, the high level of agricultural production, and the surpluses generated as a consequence, had facilitated the growth of cities.

The increase in total and urban population and the proportion of urban to total population in India is presented in the table below. In the year 2011 total

urban population accounts 31.16% ie more than three times as in the year 1971. The number of towns in relation to the population has increased more than twice in the year 2011 as compared to 1971. According to the Census, 2011 there are 53 urban agglomerations in India against 35 in 2001. About 43 percent of urban population lives in these cities. The highest urban exponential growth rate reached 3.79% in the decade 1971-1981.

Table - 2

Year	Total Population	Urban Population	Percentage of Urban Population	Number of towns/ urban area
1971	548.16	109.11	19.91	2590
1981	683.33	159.46	23.34	3378
1991	846.39	217.55	25.72	3768
2001	1027.02	285.35	27.78	5161
2011	1210.19	377.1	31.16	7935

In the last decade, as population of India grew at an average annual rate of 2 percent, urban population grew at almost 3per cent per annum, population of mega cities at 45 percent per annum.

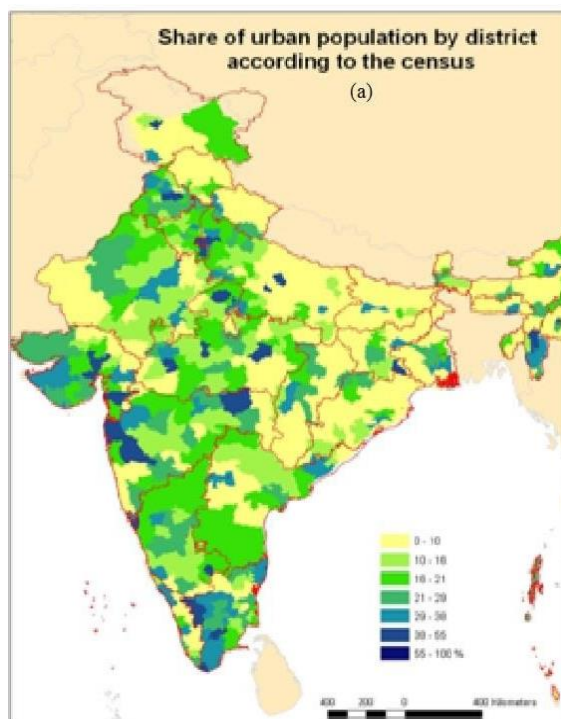


Fig.2

Source: Census of India 2001

Table – 3: Level of Urbanization in Major State of India-1991 to 2011(In percentage)

States	1991	2001	2011	Rank 1991	Rank 2001	Rank 2011
Andhra Pradesh	26.89	27.30	33.49	8	7	7
Assam	11.10	12.90	14.08	15	15	14
Bihar	13.14	13.35	11.30	14	14	15
Gujarat	34.49	37.36	42.58	3	2	4
Haryana	24.63	28.92	24.25	6	9	11
Karnataka	30.92	33.99	38.57	4	4	5
Kerala	26.39	25.96	47.72	9	8	2
Madhya Pradesh	23.18	24.82	27.63	10	10	9
Maharashtra	38.69	42.43	45.23	2	1	3
Orissa	13.38	14.99	16.68	13	13	13
Punjab	29.55	33.92	37.49	5	5	6
Rajasthan	22.88	23.39	24.89	11	11	10
Tamil Nadu	34.15	44.04	48.45	1	3	1
Uttar Pradesh	19.84	21.02	22.28	12	12	12
West Bengal	27.48	27.97	31.89	7	6	8
India	25.72	27.78	31.16	-	-	-

Source: Census documents, respective years

Table - 4

Rank	City	Population in Million			
		1971	1991	2001	2011
1	Bombay(Mumbai)	5.97	12.57	16.37	18.39
2	Calcutta	7.42	10.92	13.22	14.05
3	Delhi	3.65	8.38	12.79	16.34
4	Madras(Chennai)	3.17	5.36	6.42	8.65
5	Hyderabad	1.80	4.28	5.53	7.67
6	Bangalore	1.66	4.09	5.69	8.52
7	Ahmadabad	1.75	3.30	4.52	6.35
8	Pune	1.14	2.49	3.75	5.05
9	Kanpur	1.28	2.11	2.69	2.92
10	Nagpur	0.93	1.66	2.12	2.49
11	Lucknow	0.81	1.64	2.27	2.90
12	Surat	0.49	1.52	2.81	4.59
13	Jaipur	0.64	1.52	2.32	3.04
14	Kochi	0.51	1.14	1.35	2.02
15	Coimbatore	0.74	1.14	1.45	2.13
16	Vadodara	0.47	1.12	1.49	1.82
17	Indore	0.56	1.10	1.64	2.17
18	Patna	0.56	1.10	1.71	2.05
19	Madurai	0.71	1.09	1.19	1.46
20	Bhopal	0.38	1.06	1.45	1.88
21	Vishakhapatnam	0.36	1.05	1.33	1.72
22	Varanasi	0.64	1.03	1.21	1.43
23	Ludhiana	0.40	1.01	1.40	1.61

Source: Census of India

The urbanization pattern of India is characterized by continuous concentration of population and activities in million plus cities. Modernization of cities is one of the main factors behind the increase in the number of cities and the population therein (Tripathi S, 2018).

The higher demographic growth in larger cities allowed urbanisation process in India to be oriented towards large cities. Urbanization process is not mainly "migration led" but a product of demographic explosion due to natural growth added a huge population of about 40 million in the urban areas during 2001-2011 (Bhagat, 2011) and lopsided

urbanization induces growth of class-I cities (Jaysawal, 2014). A major chunk of urban population in India is concentrated in class I cities. According to the report on 'India's Urban Awakening' by McKinsey Global Institute, in the next 20 years, India will have 68 cities with a population over one million – up from 42 today. That is nearly twice as many cities as all of Europe. At present India has six cities in the category of 'fastest growth' These cities play a vital role in the demographic change of the country as well as growth of its economy Delhi is the largest city in India followed by Kolkata, Mumbai, Bangalore, Chennai and Hyderabad. These cities contributed

the largest growth of population in the period of 2010-2015. With the mess that most Indian megacities are in, it is inevitable not only to drastically take steps to rehabilitate infrastructure in existing cities but build new cities to accommodate this burst in urban population.

Table 4 shows top 23 million plus cities in India The population of these cities is given for the years 1971 to 2011 and accordingly these cities is ranked from 1 to 23.

Comparison and Conclusions:

The population trends in EU countries shows that in some countries there is drastic change in population either negative or positive. There's still an important gap between Western and the Emerging Europe. The population in countries like Croatia, Latvia, Lithuania and Romania shows increasing trend from 1971 to 1991 but decreases from 1991 onwards But in countries like Bulgaria, Estonia and Hungary the population has increased from the year 1971 to 1981 but again decreased in the next decades. Remaining countries shows increasing trend of population. Differences between Western and Eastern Europe also observed at regional levels. Almost three quarters (72.5 %) of EU28 inhabitants lived in cities, towns and suburbs in 2014. There are considerable differences in the size and spatial distribution of urban development between European Union (EU) Member States e.g. the Netherlands is characterised by a high level of population density and a high share of urban land use, whereas in most of the Nordic Member States and the interior of the Iberian Peninsula much lower levels of urban land use are commonplace (Eurostat, 2016).

In India the population of cities with more than one million inhabitants has been keep growing at a very rapid rate. Number of million plus cities has increased from 5 in 1951 to 23 in 1991 and to 35 in

2001 About 37% of the total urban population live in these million plus cities. As per 2001 census the newly added million plus cities are 12 in numbers, they are Agra, Meerut, Nashik, Jabalpur, Jamshedpur, Asansol, Dhanbad, Faridabad, Allahabad, Amritsar, Vijaywada, Rajkot. Out of 468 UAs/Towns belonging to Class I category, 53UAs/Towns each has a population of one million or above each Known as Million Plus UAs/Cities, these are the major urban centres in the country 1607 million persons (or 42.6% of the urban population) live in these Million Plus UAs/Cities 18 new UAs/Towns have been added to this list since the last Census. To implement the smart cities mission and planned development strategy it is also important to look into the level of urbanization across states and union territories It will be helpful for the prioritization and selection of cities for planned sustainable development. According to census 2011, the level of urbanization across states and union territories there are seven states & union territories viz. Delhi, Chandigarh, Lakshadweep, Daman and Diu, Pondicherry, Goa, Mizoram which accounts more than 50% urbanization Tamil Nadu, Kerala, Dadra & Nagar Haveli, Maharashtra and Gujarat comes under 40 % to 50% urbanization category Karnataka, Punjab, Andaman and Nicobar Islands, Haryana, Andhra Pradesh and West Bengal are at the level of India average to 40% There are 13 states viz. Uttarakhand, Manipur, Nagaland, Madhya Pradesh, Jammu and Kashmir, Tripura, Sikkim, Rajasthan, Jharkhand, Chhattisgarh, Arunachal Pradesh, Uttar Pradesh, and Meghalaya having urbanization. Below India Average Orissa, Assam, Bihar and Himachal Pradesh are the four states accounts less than 20% urbanization.

While comparing the smart cities in Europe and India makes some difficulties like the development factors in both the countries are not similar of the social and economic status in both have more distance Considering these facts India is trying to

accelerate the development of its cities with the same western approach which is leading many problems in the development of smart cities. The trends in population in both EU and Indian cities makes more different scenario. Analyzing the sustainability in cities while comparing the population changes is then important as population changes have made impediment for the development and execution in the policy making of smart cities in both EU and India In Europe the cities were already built in such a way that the it look like a planned cities, many of the cities in Europe are ancient and medieval cities which are now preserved as it is as monuments. When it comes to Smart cities and its policy and management the population and its distribution makes an impact in the execution of various plans and framing the structure of smart city. The concept of smart city has emerged in India in the year 2015 which the advent of Smart cities Mission with various umbrella projects like e-governance, digital India etc. While doing these it should be considered that the population in India plays a vital role in deciding that at how much level and to what extent these type of missions are going to be sustain India's economy is at the initial stage of development and the cities are vital component to that Smart cities mission of India is going to increase overall quality of life and standard of living. Therefore, it is a need to study the urbanization phenomenon at various levels to understand subtle changes in the trend To study the urbanization phenomenon at city level is helpful for providing micro level distinctiveness of various feature of the city It is also useful in building smart cities in India for the effective implantation of the policies and programmes. In diverse countries like India adoption of strategies based on the micro level situations is vital for the development of cities and management of resources in urban areas. Most cities in Europe and America were established in the 19th century when there was easy availability of land, gas and water India is a late starter and is far more

crowded and complex In largest cities between 40-60 percent of population is currently living in slums and subset dwellings where they lack basic urban amenities. Although such a rigorous development of urban areas has resulted in temporal comparability of date and many towns were identified so in earlier census too as the census data could be used for portraying the size and growth of the urban population. Therefore India requires a far more efficient and sustainable solution for servicing urban areas and can reap the benefits by using technology to learn from practices from other parts of the world. It has been seen that India doesn't get a chance to induce its technology in agriculture and too colonial rule was the main impediment to the same resulted an Indian economy to lag behind. However, an equally strong and vocal viewpoint asserting that the process of urban development in India is not necessarily positive, as it is associated with the accentuation of regional and interpersonal inequality and, unfortunately, with little reduction in poverty. Thus India, too, is on the road to building smart cities - world-class, self sustainable habitats with minimal pollution levels, maximum recycling, optimised energy supplies and efficient public transportation Responsive and accountable policies are needed to support sustainable development.

Note:

* (The European Free Trade Association is a regional trade organization and free trade area consisting of four European states: Iceland, Liechtenstein, Norway, and Switzerland)

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Urban Flood Susceptibility Modelling Using AHP and GIS Approach: Case of Bhubaneswar Municipal Corporation, Odisha

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Abstract:

Floods are considered as the natural hazards that affect the world's major metropolises the most. Thus, the present study aimed at evaluating the sensitivity to flood risks in Bhubaneswar city. The methodological approach adopted was to identify the factors that most favour the risk of flooding in the area from intense literature review and field investigations; the analysis of these factors using the Analytical Hierarchy Process (AHP) approach coupled with the Geographical Information System (GIS) environment. The results reveal that among the eight parameters of the natural environment (elevation, drainage density, rainfall, slope, soil, flow accumulation, geology and land cover) selected, the land cover, geology, slope are the factors that most influences the flooding phenomenon in the area. The Flood disaster has significant influence by Anthropogenic impacts. insufficient solid waste management, massive encroachments and un-controlled growth, hydraulic inefficiency of existing drains are the major cause for the flooding in the area.

Key words: Natural Hazard, BMC, DEM, Flood Hazard, Analytical Hierarchy Process (AHP), Consistency ratio, Flood susceptibility

Highlights:

1. Flood susceptibility modelling based on geo-environmental and anthropogenic factors.
2. Land use-land cover, slope and geology are the main factors which considerably contribute to the flood phenomenon.
3. Flood risks are accentuated by human activities and climate change.
4. Points that are regularly subject to flooding are to validate the flood susceptibility model.

Introduction:

The management of water resources and associated hydrological risks is becoming a major concern in our societies. Being the wide range of hydrological hazards around the world, floods are the most frequent and damaging. These problems in city areas are gradually increasing if changes are not made to the haphazard development of buildings, infrastructures and poor urban drainage management and leads to great obstructions of daily life in the city. The study of urban flooding requires identification of flood prone areas and also the factors affecting it mostly. Catherin R Sebastian et al. (2016) determined flood prone areas of urban area of Thiruvananthapuram (Trivandrum), Kerala State, India by creating a flood hazard map in a Geographic Information System (GIS) platform, determined the optimal positions of storm water

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drains by demarcating flow routes of natural drainage and their sub-catchments from “ASTER DEM”. Yashon O. Ouma et al. (2014) mapped flood prone areas of the Eldoret Municipality in Kenya. The study integrates “Analytical Hierarchy Process (AHP)” and “Geographic Information System (GIS)” analysis techniques to estimate the magnitude of flood risk areas, followed by a multi-parametric approach and included some flood causing factors for the flood susceptibility mapping. Several areas and major roads of Bhubaneswar Municipal Corporation remained water-logged for hours while flash flood conditions caused several vehicles to be struck in water. The condition of sewerage and drainage network is poor and unspecified. Hence cannot cope with the volume of water, mostly blocked by rubbish and non-biodegradable garbages. Illegal connections cause overflow of sewers, which is also unable to cope with the increased volumes. The flood ways are obstructed due to messy developments by encroaching floodplains reduces natural flood storage. Currently, increasing rate of impermeable surface in urban areas such as roads, roofs and paving means more run-offs. Precipitation follows quick reduction of the time to peak and produces higher peak flow in the drainage channels.

The city of Bhubaneswar has 10 major or primary drains and several secondary and tertiary drains flowing adjacent to the roads, flood plains, open areas and nearby areas have been recently developed into built areas- few converted to residential areas, others are encroached by city dwellers. The areas such as Acharya Vihar, Jayde Vihar, GGP colony, Satyanagar, Laxmisagar, Bomikhal, Oldtown, Rasulagah, Kalpana, Mancheswar, VSSnagar, Chakeisiani, Nayapalli, Beherasahi, Paikanagar, satabdinagar, Jagamohan Nagar, experiencing recurring localized flooding.

Thus, the objective of the present study is to conduct

an accurate mapping of flood susceptibility areas in the urbanized BMC area using the Analytical Hierarchy Process (AHP) coupled with the Geographic Information System (GIS). The AHP is established using existing conditions as a reference and previous work to evaluate the importance of parameters on defining flood zones. GIS facilitates the processing and analysis of spatial data and facilitates the visualization, interpretation and evaluation of the results of the AHP. The approach proposed in this study is applied for the first time in the study area. It allows us to compare the parameters, test them and rank them according to their intervention in the production of flooding in the study area.

Material and Methods

Study area

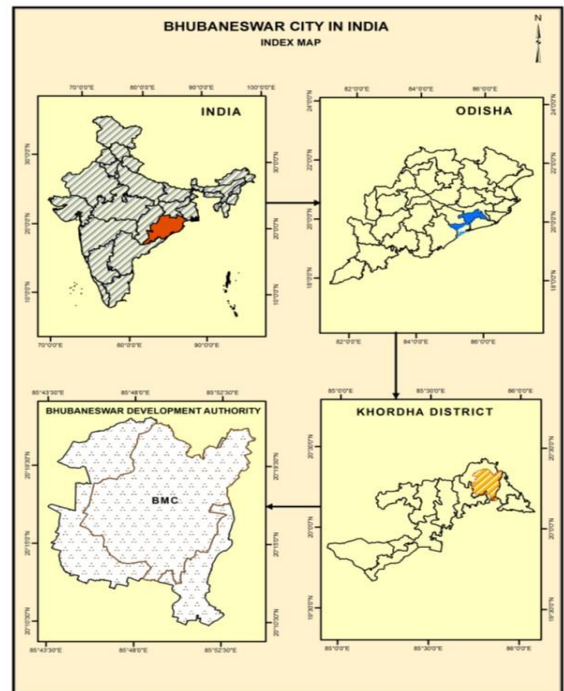


Fig.1: Study area

The capital city of Odisha i.e Bhubaneswar is located between 20.2961° N latitude, 85.8245°

Elongitude on the western fringe of the odisha coastal plain across the main axis of Eastern Ghats in Khurda district of Odisha. The city lies on the low lateritic plateau and the erosion has made its topography a valley-and-ridge type, having series of drainage channels flowing from west to east. The average elevation is 45 m above sea level. The location of the city (Fig.1) is almost central in between Kolkata & Chennai.

consisted of: 1) identifying the parameters that have more or less an impact on the flood phenomenon. This was done on the basis of an intense literature review on the flood theme coupled with several field observation campaigns; 2) the calculation of the Flood Hazard Index (FHI) using Analytical Hierarchy Process (AHP) and the Geographical Information System (GIS) environment, in order to identify a flood susceptibility to flooding in Bhubaneswar City. This methodology (Fig.2) was completed by the validation of the latter based on the verification of field data.

Description of method

The methodological approach used in this study

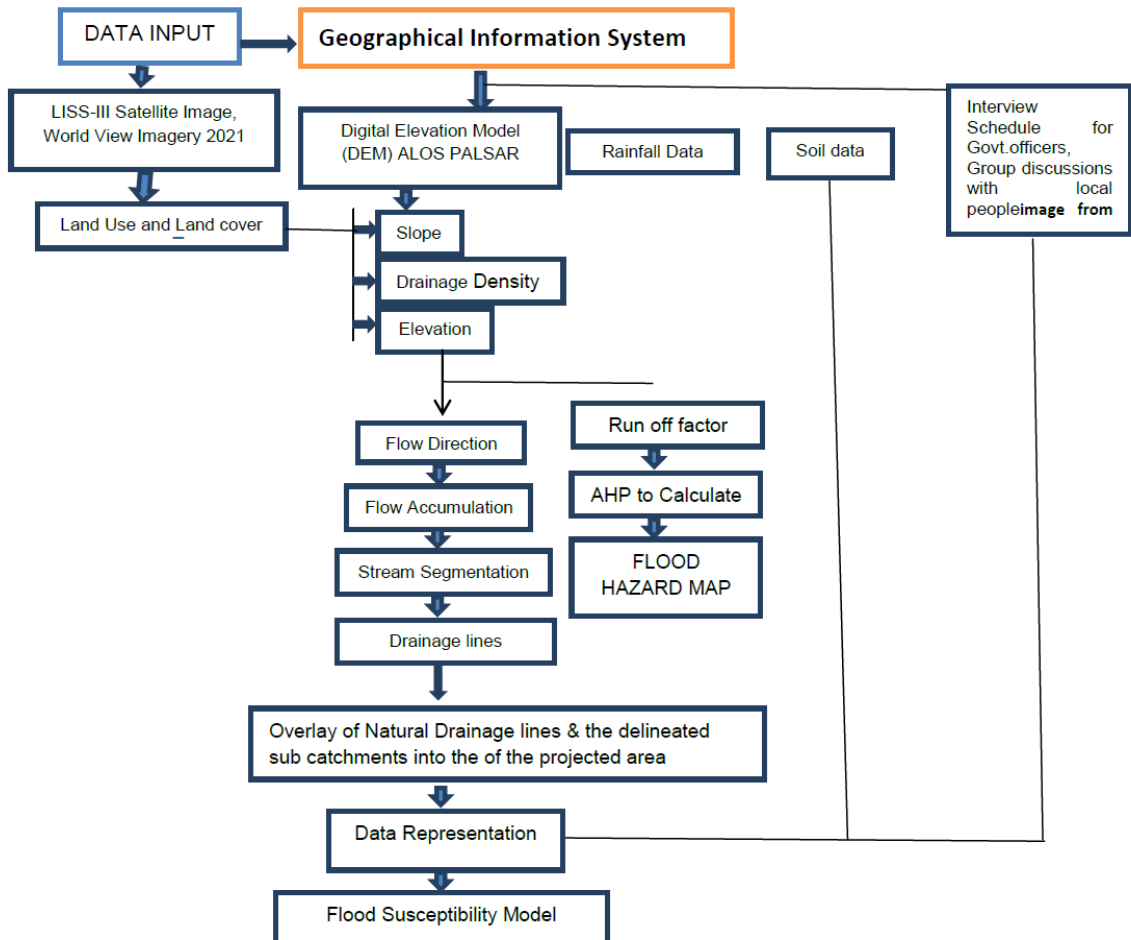


Fig.2: Flow Chart of Methodology

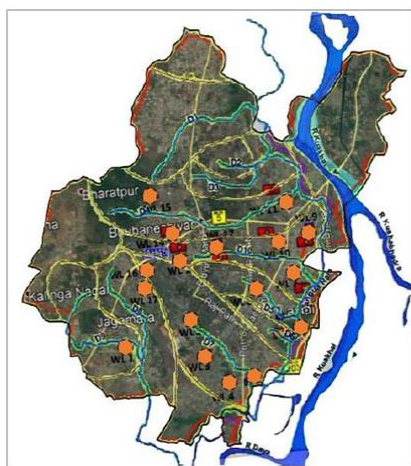
In the present work, ALOS PALSAR DEM of 12.5 resolutions, GIS and AHP (Analytical Hierarchy Process) techniques have been applied for study of urban flood susceptibility of Bhubaneswar. Purposive sampling technique has been employed for the selection of the study area i.e; drain catchment no.4 and 10 respectively, as these areas

been the worst flooding event affected from last couple of years. Also 28 years of Rainfall data included for the calculation of surface run off using the guidelines of “CPHEEO (CENTRAL PUBLIC HEALTH AND ENVIRONMENTAL ENGINEERING ORGANISATION)” manual.

Results and discussion

Table-1: Status of existing storm water drains in Bhubaneswar

Drain No	Drain Name	Starting point	Outfall point	Length (in km)	Catchment Area (km ²)
1	Patia	Forest Lake, Chandrasekharpur	Daya west Canal Crossing	4.32	16.93
2	Sainik School	Back side of Sainik School Road Culvert	Confluence point of Drain no-3 near VSS Nagar, Railway Bridge	1.13	1.44
3	OAP area	Field near Sainik School	Railway Bridge (Confluence with Drain no 2)	2.42	3.31
4	Vani Vihar	Culvert near Reserve Forest Bharatpur	Gangua Nalla	5.63	13.67
5	Laxmi Sagar	Culvert at Janpath road	Ganuga Nalla	3.13	3.66
6	Baragad Area	Railway Bridge	Ganuga Nalla	2.61	2.89
7	Kedargouri	Culvert at Airport Road	Gangua Nalla	4.34	9.46
8	Airport Area	Jokalandi Road	Confluence Point of Drain no - 9	4.33	12.99
9	Ghatikia	Culvert near on NH-5	Pokhariput Railway Bridge	4.24	12.55
10	Nico Park	Lake near CRP Colony	Gangua Nalla	5.48	10.28



- WL1 Jagmohan Nagar
- WL2 Ganga Nagar
- WL3 Aerodrome Area
- WL4 Gouri nagar
- WL5 Samantarapur
- WL6 Laxmi sagar
- WL7 Jharpada
- WL8 Sabar Sahi
- WL9 GGP Colony, Palasuni
- WL10 Shahid Nagar
- WL11 Mancheswar Industrial Area
- WL12 Acharya Vihar
- WL13 Behera Sahi
- WL14 ISCKON Temple
- WL 15 Ekamra Park
- WL16 Paika Nagar
- WI.17 Satabdi Nagar

Fig.3: Major water logging points of the city due to choking of drains

All the 10 natural major drains, flow from west to east, having length of 71 km that possess 45.29% of drainage coverage in the city. Above all kuchha drains acute severity is seen along major drains no.4, 10. Inefficient solid waste management leading to choking of drains, massive encroachments, uncontrolled growth being the core problem of inundation or flooding in the city.

Table-2: Major flood events occurring area in catchment 4 & 10

Sl No	Location	Ward No	Drain No
1	Nayapalli, Acharya Vihar, Near Iskon temple, Jaganath Nagar, Bhagabat Sandhan, Andharua, Jayadev Vihar, Samantapuri, RRL, Vani Vihar, Sahid Nagar	6, 7, 8, 9, 10, 11, 12, 32, 33, 34, 35, 36, 37, 38, 41, 43, 44, 45	4
2	Jharpada, Bomikhal, Satya Nagar, Govind Prasad, Shanti Nagar, Madhusudan Nagar, Power House Square, Bhoum Nagar, Satya Nagar, Gopabandhu Nagar, Kharvela Nagar, Bhoi Nagar	7, 8, 10, 19, 20, 21, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 44, 45, 46, 47, 48	10



Fig.4: waterlogging situation at iskon, Nayapall

Existing Status of Catchment Area of Drainage No.4 & 10

Due to encroachment along drain no 4, sections of effective area available for storm water flow has reduced. Along the stretch of Drain no.10 area near the Daya west branch canal experiencing regular flooding events, causing rupture of the drain leads to spill over of storm water to the locality posing severe health and safety hazards. This is a resultant of severe encroachment. Inadequate drainage channel and haphazard development of catchment areas especially in upstream side of Acharya Vihar, encouraging floods in the area.

Inference

- The hydraulic insufficiency of existing drains unable to carry out the surface runoff
- Indiscriminate dumping of solid waste, building materials and related refuse gave rise to choked drains
- Drains are mostly silted and collapsed, leading to reduction of the effective cross-section and resulting in waterlogging of the land
- Mostly the encroachments are practised along roads, drains, wetlands, water bodies etc.
- The areas where the drains are fully covered and the inlets into the drains are either too small or choked by solid waste, are most prone to inundation.

Multi-influencing factors of flood-susceptible zone

Topography

In the current study, flood susceptibility analysis comprises of ground elevation, topographic standard deviation, and slope as the main elements for topography. The study area is categorized into 5 types of elevation level from east to west. Naturally the eastern low land having gentle elevation slope is prioritised with the highest rating as susceptible areas.

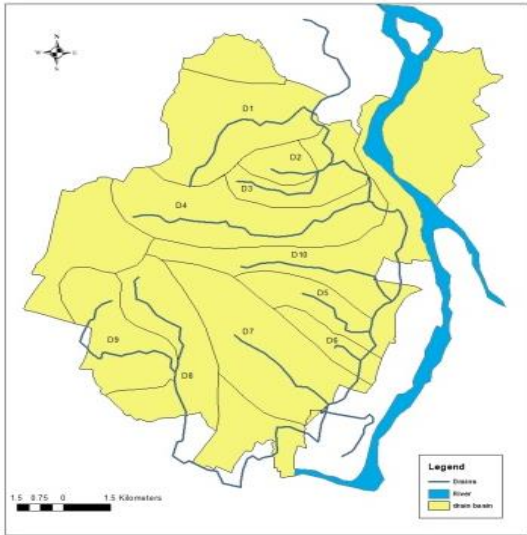


Fig.5: Major drains & catchments
Source: GIS Analysis

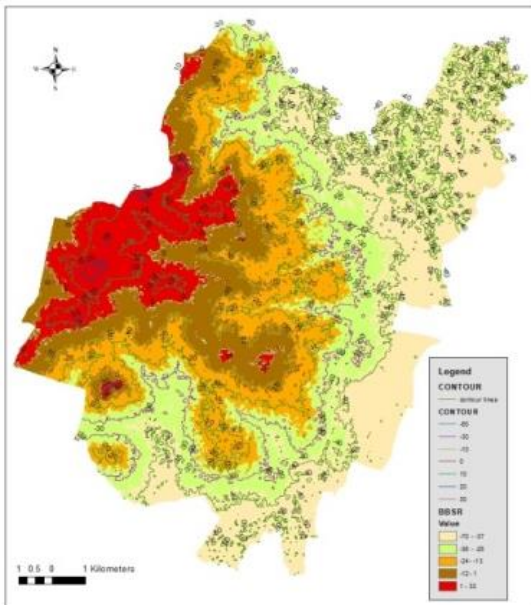


Fig.6: Contour map of Bhubaneswar
Source: GIS Analysis

Drainage Density

The “drainage density” of the watershed is calculated as: $D = L / A$,

*L=Length of the drain, A=Area of the catchment.

*DD:<1=low, (1-5)=moderate, ≥5 = High. The maximum value of “drainage density” found in the region is 0.563 Km/Km² (<1; low)

- For Drain catchment no.4= 5.63km/13.67km²=0.411 (<1;low)
- For Drain catchment no.10= 5.48/10.28km²=0.533 (<1;low)

The catchment no.4 and 10 showing low drainage density, i.e; grounds are permeable.

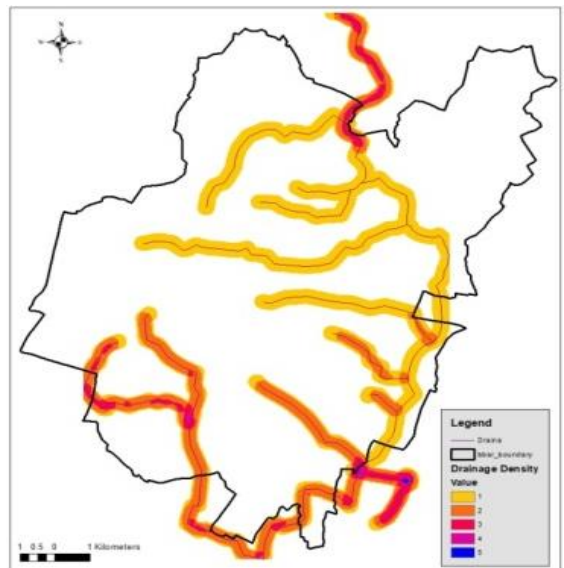


Fig.7: Drainage density
Source: GIS Analysis

Soil

Among all the five types of soil i.e.; (mixed, loamy skeletal, fine mixed, fine loamy, course loamy) most of the area of Bhubaneswar city lies under fine loamy and fine mixed type. The maximum area of drain catchment area 4 and 10 having fine loamy soil type which shows acceptable permeability and eastern part of the catchment area (very less area) coming under fine mixed soil category that shows low permeability on ground.

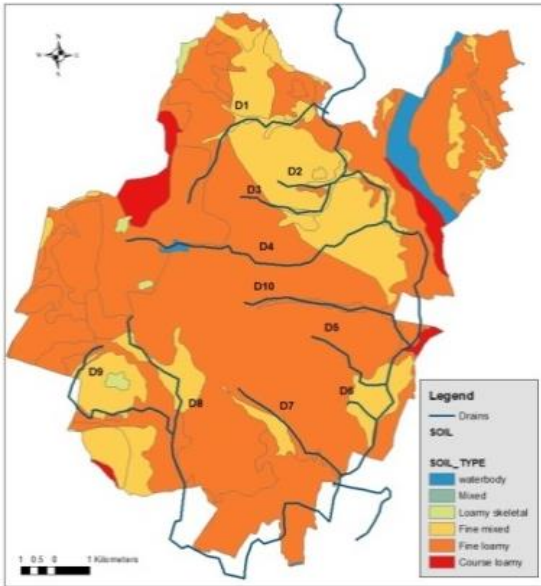


Fig.8: Soil
Source: GIS Analysis

Slope

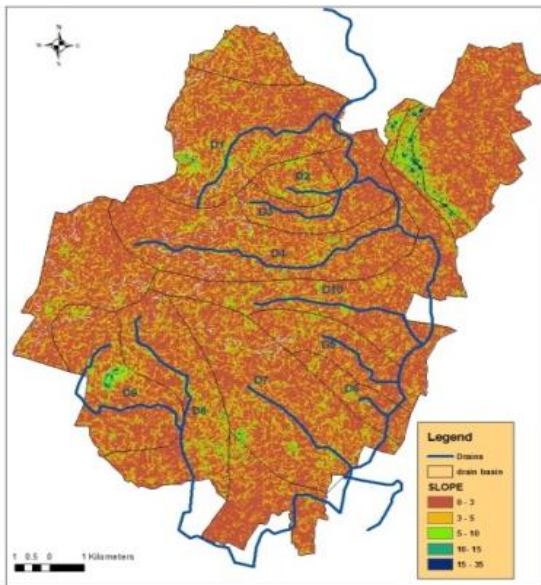


Fig.9: Slope
Source: GIS Analysis

Western uplands of the city have high degree of slope value and eastern part of study area is covered

by low to medium slope category. Slope of the study area assigned as 0°-3°, 3°-5° and 5°-10°.The region is lies in a moderately steep slope. Most of the study area falling under moderate to high flood vulnerable zone.

Flow Direction

Flow direction output generated showing drainage paths from each cell to all possible directions.The flow direction values indicate the direction of the steepest area.

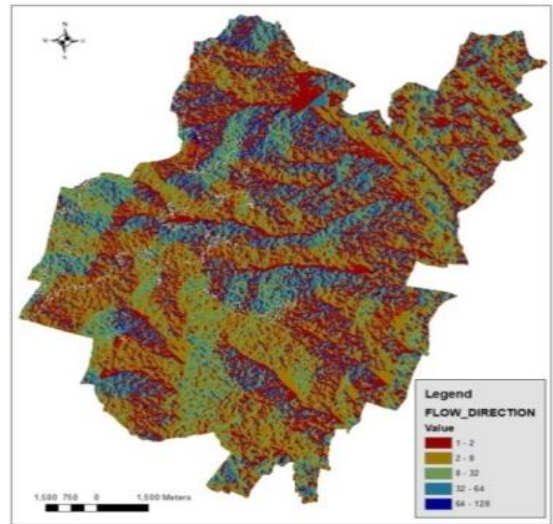


Fig.10: Flow Direction
Source: GIS Analysis

Flow accumulation

The flow accumulation grid for the Bhubaneswar catchment identifies accumulation of drainage areas at the downstream section of the city. The areas demarcated in map below shows the higher accumulation point that leads to flooding especially at drain no.4 & 10 basins have higher accumulation value respectively.

Stream segment implicates delineation of natural flow routes and its sub catchments which are overlaid with existing storm water drains which shows the drains are perfectly aligned and should not impose any flooding in the study area.

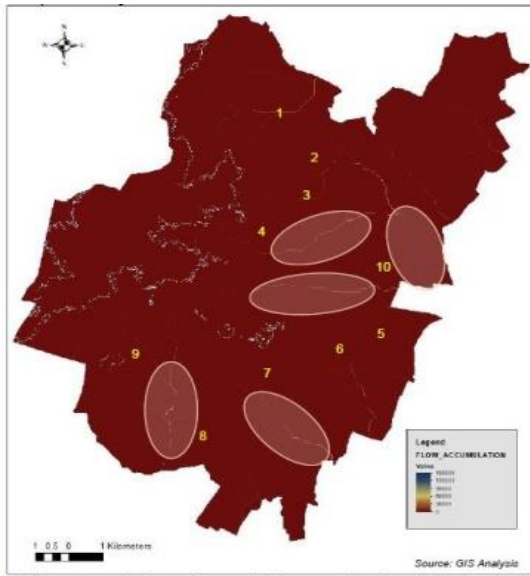


Fig.11: Flow Accumulation
Source: GIS Analysis

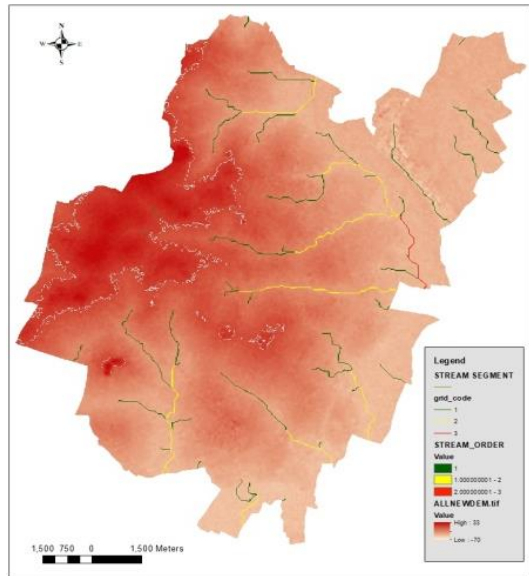


Fig.12: Stream segmentation
Source: GIS Analysis

Rainfall analysis

Rainfall analysis includes estimation of Intensity-Duration-Frequency curve that is required in runoff calculation of storm water drains and I-D-F is rainfall dependent. As duration increases intensity decreases. The Intensity-Duration-Frequency curve for various return period is presented in Figure 1.12 below. The return period for urban storm sewer is

dependent on the area's importance, which indicates Commercial and industrial areas are less frequent to flooding. Bhubaneswar being fast growing urban centre is yield to have rainfall of small concentration of time. So for the calculation of urban storm water runoff, rainfall intensity is determined to be 28.88mm/hr, considering 2 hrs. of storm duration and 2 years of return period from the collected data.

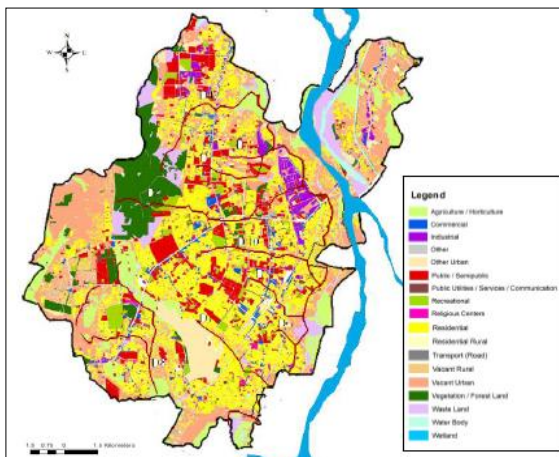


Fig.13: Land use of Bhubaneswar
Source: GIS Analysis

- Residential-37.04 (In sqkm)
- Commercial- 6.32
- Industrial- 3.63
- Public utility-18.60
- Agriculture -28.12
- Forest land- 29.53
- Transportation-15.46
- Wasteland-8.81
- water bodies/wetland-4.43
- Vacant land-31.93
- Others-2.16

Runoff coefficient as per CPHEEO Guidelines

- Residential-0.7
- wetland-0.1
- Commercial-0.8
- vacant land-0.3
- Industrial-0.7
- Public utility-0.5
- Cultivable land-0.4
- Forest land-0.2
- Roads-0.8
- Waste land-0.3
- others-0.2

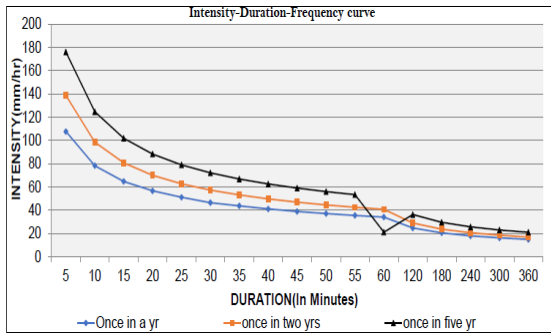


Fig.14: showing I-D-F Curve for Various Return Periods (as per CPHEEO manual)

Source: Analysis

The imperviousness of drainage basin (weighted average) for the flow concentrating at a point is estimated as $C = \frac{A1 \cdot C1 + A2 \cdot C2}{A1 + A2}$, 'C' is the runoff coefficient; 'i' is the rainfall intensity in mm/hr and 'A' is drainage district Area in hectares.

$$C = \frac{0.7 \times 37.04 + 0.8 \times 6.32 + 0.7 \times 3.63 + 0.5 \times 18.60 + 0.4 \times 28.12 + 0.2 \times 29.53 + 0.8 \times 15.46 + 0.3 \times 8.81 + 0.1 \times 4.43 + 0.3 \times 31.93 + 0.2 \times 2.16}{186} = 0.45$$

And the surface runoff, $Q = 10 C i$
 $A, Q = 10 \times 0.45 \times 28.88 \text{ mm/hr} \times 186 = 24172.56 \text{ m}^3/\text{hr}$.

The weighted run off coefficient for every individual catchment shows the runoff characteristics of the catchment areas of drains.

Weighted runoff coefficient of Catchment = $\frac{[C (\text{Runoff coefficient}) \times \text{Area of the Catchment}]}{\text{Total catchment area}}$

- $C1 = (0.45 \times 22.50) / 186 = 0.057,$
- $C2 = (0.45 \times 3.14) / 186 = 0.0080,$
- $C3 = 0.45 \times 5.25 / 186 = 0.0134,$
- $C4 = (0.45 \times 17.45) / 186 = 0.0418,$
- $C5 = (0.45 \times 4.62) / 186 = 0.0118,$
- $C6 = (0.45 \times 2.80) / 186 = 0.0071,$
- $C7 = (0.45 \times 10.58) / 186 = 0.0270,$
- $C8 = (0.45 \times 12.17) / 186 = 0.0311,$

$$C9 = (0.45 \times 22.25) / 186 = 0.0568,$$

$$C10 = (0.45 \times 11.22) / 186 = 0.0286$$

Due to impervious surfaces catchment 4,9,10 have relatively high surface runoff respectively

The five factors (**Elevation, slope, soil, Flow accumulation, drainage density**) were used for pairwise comparison and the weights' normalization

for delineation of "Urban Flood susceptibility Zone (UFVZ) map" in the "region". The "AHP" comprises evaluation criteria & alternatives, from which a decision is to be taken. It includes generation of a numerical weight or priority or relative importance by the decision maker for each evaluation criterion on basis of pair wise comparisons as per their relative importance, to the goal, two at a time in the hierarchy. A preference matrix is calculated according to the importance of each of the indices, and all of the resolute correlations are compared in pairs. The weights are then calculated on basis of different combination factor, and the assessment results were obtained.

Method of assignment of weights

The AHP fundamental scale in fig 1.12 is used in assigning the weights. The evaluation is performed through decision maker's judgment. Subclasses are analysed individually. Numerical priorities are ascertained for each alternative 'decision'. High assigned weight depicts more importance of the corresponding criterion. Higher score denotes better performance of the considered criterion.

1/9	1/8	1/7	1/6	1/5	1/4	1/3	1/2	1	2	3	4	5	6	7	8	9
Extreme	Strong	Moderate	slight	Equal	Slight	Moderate	Strong	Extreme								
← LEAST IMPORTANT								→ MORE IMPORTANT								

Fig.15: Assigned Continuous weightage scale of Satty's Analytical Hierarchy Process (AHP)

Table-3: Shows the priority weights given to the factors/criteria

Influencing Factor	Elevation	Slope	Soil	Flow accumulation	Drainage Density
Elevation	1	2	3	4	5
Slope	1/2 or 0.5	1	2	5	3
Soil	1/3 or 0.33	1/2 or 0.5	1	2	5
Flow accumulation	1/4 or 0.25	1/5 or 0.2	1/2 or 0.5	1	3
Drainage Density	1/5 or 0.2	1/3 or 0.33	1/5 or 0.2	1/3 or 0.33	1
sum	2.28	4.23	6.07	12.33	17

In the table above the weights of the individual factors were given on the basis of the stakeholder analysis.

Elevation is chosen first among the five flood causing factors and comparing it with every individual factor the numerical weights of these factors is given. For ex- the first one, elevation is compared with slope i.e. how important is elevation with respect to slope? And on basis of the

stakeholders priority the answer is 2. which means if slope=x, then elevation= 2x. And in the 1st matrix is given as $2x/x=2$. And the reverse value is put in the beneath row. Similarly, every individual factor is compared to each other and given priority weights. After giving weights to all the factors, the sum of all factors (row wise) is calculated by adding from top to bottom. And the sum value of each column is written in the above table 3.

Table-4: Showing pairwise comparison matrix

Influencing Factor	Elevation	Slope	Soil	Flow accumulation	Drainage Density	Criteria weights
Elevation	0.4385	0.4728	0.4942	0.3244	0.2941	0.4048
Slope	0.2192	0.2364	0.3294	0.4055	0.1764	0.2732
Soil	0.1447	0.1182	0.1647	0.1622	0.2941	0.1767
Flow accumulation	0.1096	0.0472	0.0823	0.0811	0.1764	0.0993
Drainage Density	0.0877	0.7080	0.0329	0.0267	0.0588	0.0568

The above table 4 shows the values of pairwise comparison matrix by dividing each matrix value of the column with the respective column's sum values. By adding each factors value column wise from west to east the criteria weight is calculated.

The criteria weight is an important aspect for calculation through AHP technique. These are the final weights of the factors affecting the flood susceptibility. Higher is the assigned weight more important is the corresponding criteria/factor.

Table-5: Showing the calculation of consistencies of weights

Influencing Factor	Elevation	Slope	Soil	Flow accumulation	Drainage Density
Elevation	1×0.4048	2×0.2732	3×0.1767	4×0.0993	5×0.0568
Slope	0.5×0.4048	1×0.2732	2×0.1767	5×0.0993	3×0.0568
Soil	0.33×0.4048	0.5×0.2732	1×0.1767	2×0.0993	5×0.0568
Flow accumulation	0.25×0.4048	0.2×0.2732	0.5×0.1767	1×0.0993	3×0.0568
Drainage Density	0.2×0.4048	0.33×0.2732	0.2×0.1767	0.33×0.0993	1×0.0568

After getting the criteria weights of the all criterias it is necessary to check for the consistencies of the criteria weights. To check if the calculated criteria weight values are correct or not. The values of

previously assigned weights of table 1.3 are multiplied with the corresponding criteria weight values.

Table-6: Showing weighted sum value calculation

Influencing Factor	Elevation	Slope	Soil	Flow accumulation	Drainage Density	Weighted sum value
Elevation	0.4048	0.5464	0.5301	0.3972	0.284	2.165
Slope	0.2024	0.2732	0.3534	0.4965	0.1704	1.4959
Soil	0.1335	0.1366	0.1767	0.1986	0.284	0.9294
Flow accumulation	0.1012	0.0546	0.0883	0.0993	0.1704	0.5138
Drainage Density	0.0809	0.0901	0.0353	0.0327	0.0568	0.2958

By adding the weights of each column of the above table from left to right the weighted sum value is calculated. The weighted sum value is determined to

assign the final weights to the criteria's or factors and check if these are correct or not.

Table-7: Showing calculation of final criteria weights

Weighted sum value	Criteria weights	Final Weight (by Eigen)=Weighted sum value / Criteria weights
2.165	0.4048	5.342
1.4959	0.2732	5.4754
0.9294	0.1767	5.2597
0.5138	0.0993	5.1742
0.2958	0.0568	5.207
		Sum =26.459

After dividing the weighted sum value by criteria weights the corresponding new values of each row are added to get the normalized values. The value of the Eigen vector is correlated with the maximum eigenvalues of the reciprocal matrix.

For the consistency check CI is determined from the matrix formulation.

$$\lambda_{max} = 26.459 / 5 = 5.2918$$

λ_{max} is the maximum eigen value, is divided by the number of decision factors i.e 5 to get the normalised value.

Table-8: Random Index (RI) used for CR computation

n (variables/criteria)	1	2	3	4	5	6	7	8	9	10
Random Index (RI)	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The random index is chosen on the basis of number of decision criteria. Here the number of decision criteria or factor is 5 so the previously assigned value as per table 1.8 is **1.12**.

The final C.R value is $= 0.07295 / 1.12 = 0.065$

As the final C.R value i.e. **0.065 is < 0.10** (threshold). Hence the assigned criteria weights by the decision maker is proved to be correct and applicable for further study of the flood susceptibility mapping. New thematic data layer of each factor was generated using Arc hydro tool in GIS. The thematic maps were again reclassified and proper weights were assigned on basis of their significance to urban flood susceptibility as per the “Satty’s Analytical Hierarchy Process (AHP)”.

Flood Susceptibility Map:

As shown in the above table 1.7 the factors elevation, slope, soil are given more priorities while flow accumulation, drainage density are given less priority on contribution of flood susceptibility. An overlay analysis of raster was undertaken by using common measurement scale and weights on the basis

The value of consistency index
 $(CI) = (\lambda_{max} - n) / (n-1)$

Where, λ_{max} = maximum eigen value
 n = number of variables/ criteria

$$C.I = (5.2918-5) / (5-1)$$

$$= 0.2918 / 4$$

$$= 0.07295$$

And the Consistency ratio (CR) = C.I / R.I

Where, C.I= consistency Index
 R.I=Random index

of its importance has been performed through the “Weighted Overlay” tool. The elevation map is reclassified into five classes and the lowest elevation value is given first rank as it is very highly vulnerable and accordingly the corresponding values are ranked. The highest elevation value is ranked as very low vulnerable category. Slope map is reclassified as 0-3 degree (very highly vulnerable), 3-5 degree (highly vulnerable), 5-10 (moderate), 10-15 (low), 15-35 (very low) respectively. From all soil categories mixed soil is confined as very highly vulnerable to sequentially fine mixed and fine loamy are considered as moderate to low flood vulnerable areas. The flow accumulation values are numerical from which highest value bearing high susceptibility and lowest value is sequentially confined as very low vulnerable zone respectively. The drainage density factor shows permeability of the area that defines flood risk. The drainage density map values are reclassified into five several categories showing high values of high impermeable ground i.e. very high vulnerable zone similarly the lowest value defines permeable ground i.e. very low vulnerable

area. The overlay analysis resulted into five zones such as very low, low, moderate, high and very high zones.

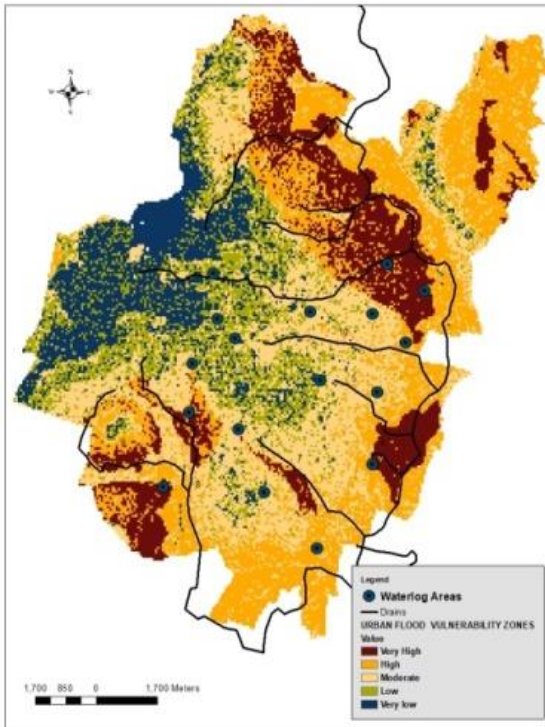


Fig.16: Flood Susceptibility map

Table-9: Showing % and area of flood prone locations in Bhubaneswar

Flood hazard zones	Area coverage, Sq. Km	Area, (%)	No. of flood prone location
Very High	21.3	14.82	4
High	41.18	28.91	4
Moderate	41.06	28.71	5
Low	20.30	14.30	4
Very Low	18.80	13.24	0

Source: GIS Analysis

“Flood Susceptibility map” is compared with the 17 flood prone areas located in Bhubaneswar city for the accuracy assessment. By plotting the frequently flood affected sites on ‘flood susceptibility zone map’ implies that, highest number of ‘flood prone

locations’ i.e 5 locations is under **moderate flood susceptibility zone** and comparatively same level of flood vulnerable locations i.e 4 locations is in **high zone, very high and low zone class**. Drain catchment no.4 and 10 falling under **moderate to low vulnerable zone** but most number of waterlog points are present in this part of the city. The result shows that, urban ‘flood susceptibility’ is highly affected by human factors like encroachment, clogging of drains, siltation, dumping of debris into drains. These factors have much influence to flood susceptibility in the study area rather than natural factors like rainfall, elevation, soil, drainage density and slope.

Conclusion

The findings of this research indicate that the city is facing flooding even in a small amount of precipitation because human development in urban areas is making urban flooding worse during rainy season. This is because most of the ground surface in urban areas is covered by impermeable buildings and roads, which rapidly divert rain water to drains and do not allow percolation of the water down through the soil. Other than that, construction work by encroachment of natural drains and dumping of waste results in blockage and choking of the storm water drains reducing its efficiency. Modelling Urban Flood Susceptibility in BMC area using AHP, GIS and remote sensing techniques can aid in identifying the zones that requires immediate action plan and quick decision-making for sustainable urban flood management plan like improving the drainage system, proper maintenance of existing storm water drainage and generation of linkages between drainage networks, adequate solid waste management. The results indicate that, in urban environmental study area, the flood disaster has significant influence by anthropogenic impacts. Urban flooding can be mitigated if urban areas are provided with efficient drainages.

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Geo-Morphosite Assessment for the Geo-Tourism Purposes of Odisha Coastal Destinations

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Abstract:

Areas of geological and geo-morphological significance may act natural heritage environment for attractive geo tourism sites along the coastal District of Odisha state Such tourism sites are not well explored and not properly maintained due to poor understanding of their natural heritage significance in tourism attraction The present paper reveals the geo-morphosite assessment for those geo tourism sites of coastal Odisha to highlight their prospects and quality and to rejuvenate the tourism process.

The weightage ranks are estimated by considering the scientific and intrinsic values, educational values, economical values, conservation values and added values for geo site ratings of tourism destinations of the coastal districts in the work Total eighteen geo sites are rated by present method and on the basis of estimated scores they are again characterized into high, moderate, low and very low intensity of geo diversity values Among them, thirteen geo sites are included within moderate and low category intensity of geo diversity and remaining two and three are identified as high and low category geo sites of the coastal zones.

The promotion of geo tourism development should be considered on the basis of geo site rating scores

for achieving success in a new of tourism processes of the prospective region.

Keywords: Geo-morpho-site assessment, Geo-site ratings, Geo-tourism destinations, intrinsic values, Conservation values, Added values

Introduction:

Geo-diversity and geo-heritage are major resources of the coastal districts for geo-tourism development in Odisha State fringed with Bay of Bengal Geo-heritage of the coastal landscapes is represented by various geo-sites and geo-morphosites of the coastal destinations Geo-sites of the existing coastal landscapes are evolved through the history of the earth system processes and bear significant scientific values for prosperous tourism destinations development However, geo-morphosites are used in wider perspectives and they include some added values like economic, aesthetic and cultural significance for geo-tourism expansion along the coastal belt Areas of geological and geo-morphological significance are assessed by following the value addition methods of Lucie Kubalikova (2013) in this part of the research work The valuation of the coastal landscape destinations provide ideal tool and appropriate use of geo-heritage is also possible by the assessment of value addition methods (Fig .1).

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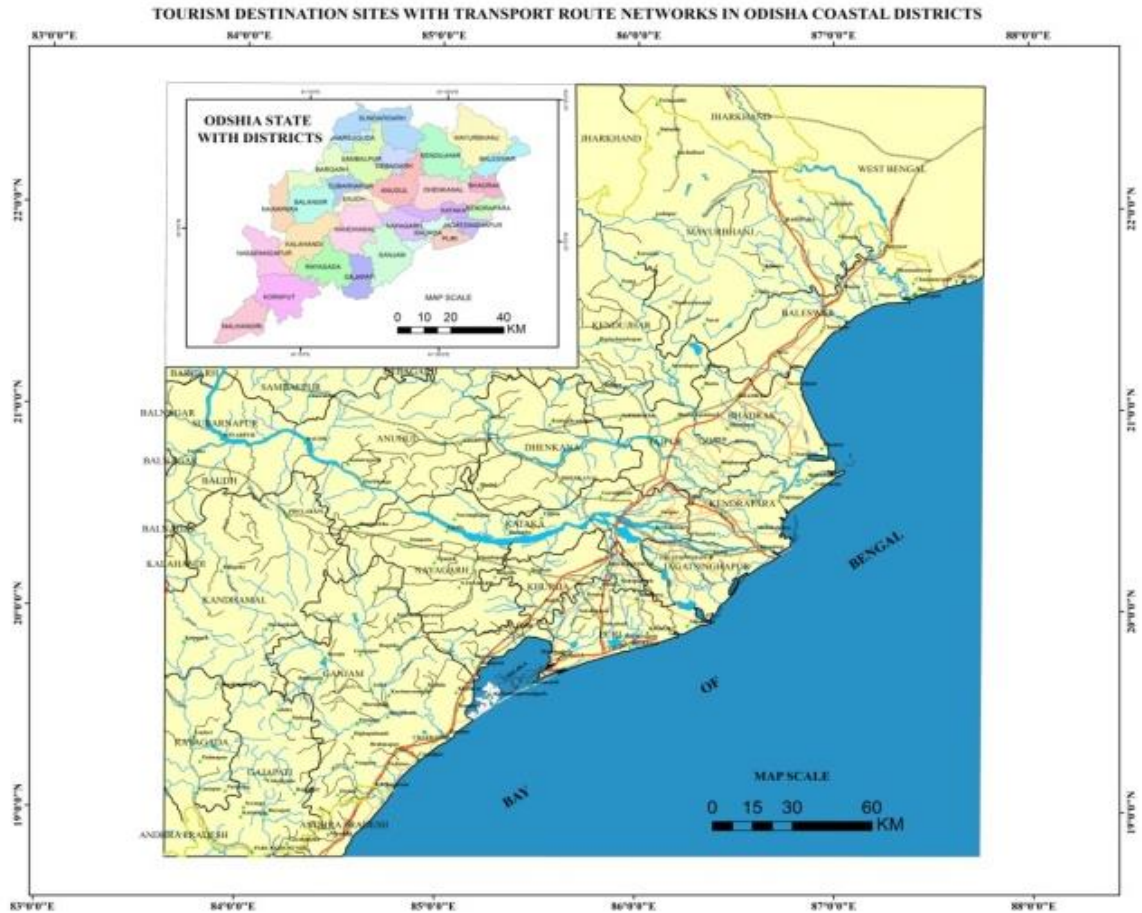


Fig. 1: Location map of Odisha coastal belt destinations

The concept of geo-diversity was introduced in Australia during the early part of 1990's and significantly defined as "Earth features and systems with their diversity" by several researchers and little bit of extended dimension (Sharples, 1993; 1995; Dixon, 1996; Australian Heritage Commission, 2002; Sharples, 2002).

According to their ideas the geo-diversity was also included "The range or diversity of geological as bedrock, geo-morphological as landform and soil features, assemblages, systems and processes" particularly by Australian Heritage Commission (1996, 2002) The broader definition of geo-diversity

was also proposed by Gray (2004) with analysis and discussion of various approaches Geo-diversity was assessed by its natural range of diversity like geological characters with rocks, minerals, fossils, geo-morphological characters with shapes, forms and processes of the lands and soil features, as well as their various assemblages, relationships, number of properties, description or interpretation and respective systems "Geomorpho diversity" was also termed by Pannizza (2009) which included the landforms, processes with subset of geo-diversity

- The values are categorized as intrinsic value or scientific value (Pannizza 2001,2009);

- Cultural value related to geo-mythology (Vitalians,2007), historical with archaeological aspects of ancient settlements and also related to spiritual and various religious aspects (Gray,2004);
 - Aesthetic value generated with beauty of geo-diversity and psychological impact on human beings as referred by Gray,(2004); Pereira,(2006) etc researchers;
 - Economic and functional value of landscapes assessed by the use of mineral resources and utilization of Landscapes (Gray, 2004); as well as geo-diversity wise heritage for geo-touristic and geo-educational awareness (Reynard et Al,2003; Pralong,2003; Panizza and Piacente, 2008);
 - Research and educational value is added with the landscapes by considering the genesis of life and landforms, stage of landscape as well as the climate and palaeo-geographic reconstructions (Gray, 2004; Panizza, 2001)
- As much as 14 areas of destination corridors are already existing in the coastal belt of Odisha at present existing in the costal belt of Odisha at present Coastal tourism in Odisha is rich in diversity because of its natural physiographic diversity and past heritage of the coastal landscapes (Table 1 & Fig 2)

Table-1: Typology of Tourism Destinations in Odisha Coast

Tourism Destination	Coastal District	Types of attractions
Bichitrapur, Talsari Udaipur	Balasore District	Mangrove Forest, Back water, Subarnarekha R, Sandy beach, Boating
Chandaneswar- Bhusundeswar	Balasore District	Temples, Coastal villages, Natures
Dogra- choumukh	Balasore District	Wide sandy beach, fishing Hr, Temple, Mangrove Forest
Chandipur-Balaramguri- Panchalingeswar	Balasore District	Sandy beach, Shallow and Wide Tidal flat, Fishing Hr, Temple, Natures(Hills)
Chandbali, Dhamra port, Kalidiana Island	Bhadrak District	Mangrove Forests, River Cruise, Boating, Port and Fishing Hr
Dungmole-Ekkakula Gahirmata	Kendrapara District	Mangrove Forests, River cruise, Boating, Wild life, Seabeach
Paradip – Devi R	Jagatsinghpur District	Sandy Sea beach, Port, Urban Area, River Cruise, Fishing Hr, Mangrove Forests
Puri-Konark- Chandrabhaga	Puri District	Sandy Sea Beach, Temple Arts, Cultural events, Sand Art, Puri urban Centre, Fishing Hr
Balikhhand	Puri District	Water sports, Wild life, Eco parks, Temples
Brahmagiri-Mirjapur- Manikpatna Gobindapatna	Puri District	Old Mouth of Chilika, Archaeological sites, Ancient ports, Temples, Water Sports, Boating, Other Heritage Sites
Satapada –Chilika Spit	Puri District	Wild life, Boating, Water Sports, New Mouth of Chilika, sandy Sea Beach, Islands Fishing Hr
Barkul-Nalban-Kalijai Islands	Khurda District	Wildlife, Water sports, Recreation, Boating, Temples, Natures
Rambha – Ghantashila- potagarh	Khurda District	Wildlife, Recreation, Boating, Watersports, Natures, Heritage Sites, Ancient Port, Sandy sea beach
Gopalpur- on -sea	Ganjam District	Old Port, Sandy Sea beach, Bluish sea, Larger Sand dunes, Natures, Fishing Villages



Fig.2: the entry point of Bhitarkanika reserve forest

Materials and Methods:

The criteria for assessment of geo-morphosites was proposed by University of Modena, Italy (Coratza and Giusti, 2005); University of Cantabria, Spain (Bruschi and Cendrero, 2005); University of Valladolid, Spain (Serrano and Gonzalez-Trueba, 2005); University of Aegean (Zouros, 2005, 2007); Pralong (2005); University of Minho, Portugal (Percira, 2007, 2010); University of Lausanne, Switzerland (Reynard et al, 2007) The final criteria are proposed on the basis of suitability of method to assess the geo-sites, and geo-morphosites for geo-tourism development along the coastal Landscapes of Odisha State (Table 2 and Fig 4)

Table-2: Method for the Geo-site and Geo-morphosite assessment for the Geo-tourism purposes of coastal destinations, Odisha state

Scientific and intrinsic values	
Integrity	0 - totally destroyed site,
	05 - disturbed site, but with visible abiotic features,
	1 - site without any destruction
Rarity (number of similar sites)	0 - more than 5 sites,
	05 - 2-5 similar sites,
	1 - the only site within the area of interest
diversity (number of different partial features and processes within the geosite or geomorphosite)	0 - only one visible features/processes,
	05 - 2-4 visible features/processes,
	1 - more than 5 visible features/processes
scientific knowledge	0 - unknown site,
	05 - scientific papers on national level,
	1 - high knowledge of the site, monographic studies about the site
Educational values	
representativeness and visibility/ clarity of the features/processes	0 - low representativeness/clarity of the form and process,
	05 - medium representativeness, especially for scientists,
	1 - high representativeness of the form and process, also for the laic public
exemplarity, pedagogical use	0 - very low exemplarity and pedagogical use of the form and process, 05 - existing exemplarity, but with limited pedagogical use,
	1 - high exemplarity and high potential for pedagogical use, geodidactics and geotourism
existing educational products	0 - no products,
	05 - leaflets, maps, web pages,
	1 - info panel, information at the site
actual use of a site for educational purposes (excursions, guided tours)	0 - no educative use of the site,
	05 - site as a part of specialized excursions (students),

	1 - guided tours for public
Ecomonomical values	
accessibility	0 - more than 1000 m from the parking place, 05 - less than 1000 m from the parking place, 1 - more than 1000 m from the stop of public transport
presence of tourist infrastructure	0 - more than 10 km from the site existing tourist facilities, 05 - 5-10 km tourist facilities, 1 - less 5 km tourist facilities
local products	0 - no local products related to a site, 05 - some products, 1 - emblematic site for some local products 1 - high knowledge of the site, monographic studies about the site
Conservation values	
actual threats and risks	0 - high both natural and atrophic risks, 05 - existing risks that can disturb the site, 1 - low risks and almost no threats
potential threats and risks	0 - high both natural and atrophic risks, 05 - existing risks that can disturb the site, 1 - low risks and almost no threats
current status of a site	0 - continuing destruction of the site, 05 - the site destroyed, but now with management measures for avoid the destruction, 1 - no destruction
legislative protection	0 - no legislative protection, 05 - existing proposal for legislative protection, 1 - existing legislative protection (Natural monument, Natural reservation...)
Added values	
cultural values: presence of historical/archaeological/religious aspects related to the site	0 - no cultural features, 05 - existing cultural features but without strong relation to abiotic features, 1 - existing cultural features with the strong relation to abiotic features,
ecological values	0 - not important, 05 - existing influence but not so important, 1 - important influence of the geomorphologic feature on the ecologic feature
aesthetic values: number of colours; structure of the space, viewpoints	0 - one colour, 025 - 2-3 colours, 05 - more than 3 colours; 0 - only one pattern, 025 - two or three patterns clearly distinguishable, 05 - more than 3 patterns; 0 - none, 025 - 1-2 05 - 3 and more



Fig.3: Potagarh heritage site on the bank of Rushikulya River

Source: (Adopted from Lucie Kubalikova, 2013; CZECH JOURNAL OF TOURISM, 2(2), 80-104, DOI:102478/cjot-2013-0005)

The rating scores are estimated for each destination site on the basis of five primary values and sixteen secondary's values of geo-morphosite significances for the coastal belt of Odisha state in the present work (Fig 3).

Results and Discussion:

Geo-site Rating of Tourism Destinations of the coastal belt of Odisha State: Following the above method of Geo-site estimations the coastal destination sites are calculated for the result of Geo-site and Geo-morphosite values (Table 3, 4 & Fig 5 and 6)

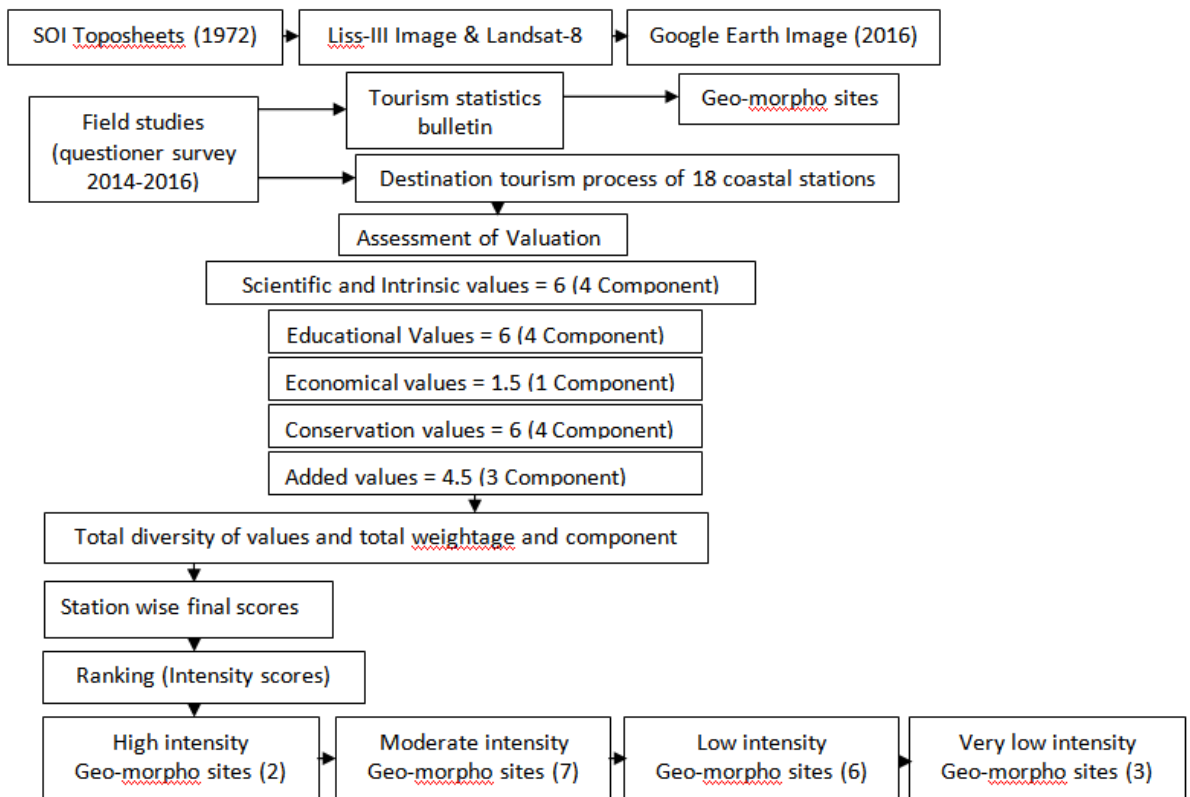


Fig.4: Methodological flow chart for estimation of geo-morphosite site assessment in geo-tourism

Table-3: Method of calculation of Geo- site rating of Coastal Destination

STATIONS	Scientific & Intrinsic Values					Educational values				Economical values			Conservation values					Added values						
	Integrity	Rarity	Diversity	SKnowledge	Total Score	Rness and Visibility	Exemplarity	Existing EProducts	Actual use of a site	Total score	Accessibility	P of tourist Infrastructure	LProducts	Total score	Actual threats and risks	P threats and risks	Current Status	Legislative protection	Total score	Cultural Values	Ecological es	Aesthetic Values	Total score	TOTAL
Chandipur-on-sea	0.5	0.5	1	0.5	2.5	1	1	1	0.5	3.5	0.5	0.5	0.5	1.5	0	0.5	1	2	3	1	1	1.5	2.25	11.75
Bhitarkonika	0.5	0.5	1	0	3	1	1	1	1.5	4.5	0.5	0	1.5	1	0.5	0.5	1	1	3	0	1	1.5	3.5	15.50
Chandbali	0.5	0	0	0	0.5	0.5	0	0	1	0.5	0	0	1	0.5	0.5	1	0	1	2	0	0.5	0.75	5.75	5.75
Bichitrapur	1	0.5	1	0.5	3	1	0.5	0.5	3	0.5	0	0	0.5	1	1	0.5	1	1	3.5	0	1	1.5	12.50	12.50
Potagarh	0	0.5	0.5	0.5	1.5	0.5	0.5	0.5	3	1	0	0	1	0.5	1	0.5	0	0	2	1	0.5	0.75	9.75	9.75
Rambha	1	0.5	0.5	0.5	2.5	0.5	0.5	0.5	3	3	0.5	0	1.5	1	1	1	1	1	4	0	1.5	2.5	13.50	13.50
Barkul	1	0.5	0.5	0.5	2.5	0.5	1.5	1.5	3	0.5	0.5	0	1	0.5	1	1	1	1	4	1.5	1.5	1	16.00	12.75
Gopalpur-on-sea	0.5	0.5	0.5	1	2.5	1	1	1	1.5	4.5	1	0.5	2.5	0.5	1.5	0.5	1	1	3.5	0.5	1.5	3	16.00	12.75
Konark-Chandrabhaga	0	0	1	1	2	1	1	1	1.5	4.5	1	1	3	1	1	1.5	1	1	4.5	1	1	1.5	17.50	17.50
Satopada	1	0.5	1	0.5	3	1.5	1	1	4	0.5	0.5	0.5	2	1	1	1	1	1	4	0	1	0.75	14.75	14.75
Mirjapur	1	0.5	1	1	2.5	1.5	0	1.5	3.5	0.5	0	0.5	1	1	0	1	1	1	3	4	0.75	12.25	12.25	12.25
Manikpatna	0	0.5	1	0.5	2.5	1	1	1	3.5	0.5	0.5	0.5	1.5	1	0.5	0.5	1	1	3.5	0.5	1	0.75	13.75	13.75
Talsari-udaipur	1	0.5	0.5	0.5	2.5	1	1.5	0.5	4	0.5	0.5	0.5	1.5	0.5	1	0.5	1	1	2.5	0	1.5	2.5	13.50	13.50
Chandaneswar-Bhusundeswar	0.5	0.5	0.5	0.5	2	0	0.5	0.5	1.5	0.5	0.5	0	1	1	1	1	0	1	3	0.5	0.5	0.75	9.25	9.25
Dogara-Chowmukh	1	0.5	0.5	0	2	0.5	0	0.5	2	0.5	0.5	0.5	2	1	1	1	1	1	4	0	1.5	0.75	12.25	12.25
Basudevpur-Dhamara	1	0.5	0.5	0	2	0	0.5	0.5	0.5	0.5	1	0.5	2	1	1	1	1	1	4	0.5	0.5	1.75	10.25	10.25
Puri	0.5	1	1	1	3.5	1.5	1.5	1.5	5.5	1	1.5	1.5	4	1.5	1	0.5	1	1	4.5	1	1	1.5	21.00	21.00
Balukhand	1	0.5	1	1	3.5	0.5	1.5	0.5	2.5	0.5	1	0.5	2	1.5	1	0.5	1	1	4.5	0.5	1	1.5	15.00	15.00

Table-4: Geo-morphosite selection scores and intensity for the coastal destination sites

Rank	Stations	Intensity	Scores
R1	Puri	High	21
R2	Konark- Chandbali		17.5
R3	Gopalpur-on-sea	Medium	16.0
R4	Bhitorkonika		15.5
R5	Balukhand		15.0
R6	Satopada		14.75
R7	Manikpatna		13.75
R8	Rambha		13.50
R9	Talsari-Udaipur		13.25
R10	Barkul		12.75
R11	Dogara-Chowmukh		12.50
R12	Mirjapur		12.25
R13	Bichitrapur	12.00	
R14	Chandipur-on-sea	11.75	
R15	Basudevpur-Dhamara	10.25	
R16	Chandaneswar-Bhusundeswar	Very Low	9.25
R17	Potagarh		8.75
R18	Chandbali		5.75

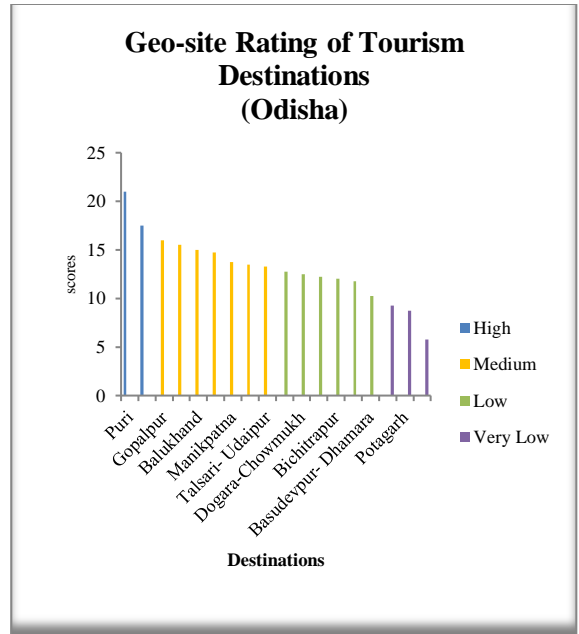


Fig.5: Geomorphosites assessment of Coastal destination, Odisha state

Holocene Geomorphology of Chilika Lagoon can be Explored with Archaeological Remains



Fig.6: Holocene dune geomorphology with the remains of archeological tools from the erosive bank of Chilika Lagoon (Near Manik Patna)

Recommendations:

The geo-morphosite significance for its geo-site rating scores, Puri and Konark-Chandrabhaga occupy major destinations for Odisha coastal zone environment. For their limitation of carrying capacities the two areas should be judged as fragile in consideration of dune and wetland habitats lying in parallel to the shoreline. Conservation practices are needed for specific compartments of these two destination sites to sustain the coastal tourism in such fragile environment through the understanding of their heritage values with geo-tourism potentialities (Fig 7).

Three other destination sites (ie Chandanesar-Bhusundeswar, Potagarh and Chandbali) of the coastal belt having estimated geo-site rating scores (below 100) of very low intensity need to improve their geomorphosite significance. All the three sites have similar locational character of river bank situation at Rushikulya River (Potagarh), Baitarani River (Chandbali), and Subarnarekha River (Chandanesar-Bhusundeswar) in the form of ancient shipping ports with gradual reduction of past glory of marine trades and commerce. Improvement of their accessibility, setting up the educative display boards for informations about the places of historical glory, and raising the values of their river bank morphosite characters should be the priority for promoting attractions to the tourists at present. The estimated geo-site rating scores (1350 to 1600, 1025-1325) of moderate and low intensities for coastal destinations reveal the potentialities of geo-tourism in the shore face. Only understanding of their geo-morphological significances by administrators, managers and individuals can help to rejuvenate the dying stage of tourism cycle of above destinations.

Major Findings:

The estimated result of geo-morphosite selection

scores are categorized into four classes intensity for identification and promotion of Geo-tourism in the coastal belt of Odisha state. They are categorized into High, Medium, Low and Very Low intensity scores. The coastal destinations of Puri, Konark-Chandrabhaga deserved the High intensity scores (21 and 175) for the promotion of geo-tourism development; and seven other sites of the coastal districts belong to the medium intensity scores of Geo-tourism prosperity (1325- 1600). The areas under Low and Very Low intensity scores are not suitable for the promotion of geo-tourism prospect. Other types of tourism have developed in the remaining destinations of the coastal belt.

Conclusions:

There are various forms of tourism in the coastal belt of Odisha state other than the form of geo-heritage significance of destinations to attract tourists from different corners of the country and abroad at present. The natural geo-heritage of the landscapes is assessed in term of geo-morphosite assessment values for each destination in the present work. The study has identified four categories geo-site intensity scores for 18 destinations in Odisha coastal belt that can highlight their potentialities and shortcomings for extension of opportunities to improve in future by tourism administrations.

Geo-tourism expansion by understanding the geo-heritage significance and geo-morphosite value addition in the above method will boost up the tourism process in a sustainable manner in the fragile coastal environment. The geo-diversity values are estimated as highest for Puri and Konark-Chandrabhaga destinations by the study. Alteration of land forms and coastal habitats up to certain extent can be allowed to expand the tourism development only in the backshores for the two attractive destinations.

TEMPLE EXCAVATION SITE OF MANIKPATANA (BHABAKUNDALESWAR) AT THE LAKE FRINGE OF CHILIKA LAGOON



Younger Dune Ridge over the Spit
Back Surface



Excavation of Lagoon Fringe Stone Steps



Degraded Temple Excavated from the Dune Ridge



Temple Side Remains of Sand Dune

RESPONDENT SURVEY ON POTENTIALITY OF ECO-TOURISM DEVELOPMENT IN THE MANGROVE BELT



Response of project operator



Response of an employee of forest department



Response of the visitors



Livelihood support system
by the mangrove ecosystem

Fig.7: Tourists survey with the set of questioner schedule at Mirzapur-Manikpatna near Chilika Lake and in Bichitrapur mangrove eco-tourism destination sites

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The resources and research facilities of the Dept of Geography and Environment Management of Vidyasagar University are fully utilized in the present work during 2015 and 2017. The final semester student of coastal management papers are highly acknowledged for their cooperation in the field work during such study. Thanks to the administrators of tourism department of Odisha, (Puri, Bhubaneswar, Bhitarkanika and Satapada) for their help to provide the tourism statistics bulletin of Odisha state and other necessary informations during the survey work.

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Geographical Analysis of School Education at Tiruchirappalli District – 2017 to 2018

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T Pavendar

Abstract:

The present research work theme is geographical analysis of school education Education enables people to develop analytical skills and cognitive abilities Education teaches children to analyse information and to utilize this acquired knowledge The present study area is an inland district located in the central segment of the state of Tamil Nadu The study area lies between 10° 15' and 11° 12' North latitudes and 78° 10' and 79° 5' East longitudes These study area are further divided into fourteen blocks The district is one of the privileged few to have the river Cauvery, biggest rivers in south India The study area experienced an average temperature of 29^o C The average literacy rate of 2011 was 83.23%. This study is mainly based on secondary data Information about the education institution and the number of students studied was collected from the statistical office in Tiruchirappalli. Use the simple statistical calculations such as percentage work to study the school educational. Analysis is based on the maps produced using the ArcGIS software.

Keywords: School, Private School, Tiruchirappalli, Primary School, Higher Secondary School, GIS.

Introduction

Education in every way is one of the fundamental factors of development No country can achieve

sustainable economic development without substantial investment in human capital. Education offers the best opportunities to win in modern society Based on knowledge, qualities, skills, attitudes, and skills, education is the process of creating a new world order that makes the conscious individuals of their growth and active responsible participants. Education is an understanding of themselves and people of the world. It improves the quality of their lives and leads to broad social benefits for individuals and communities. Education raises the productivity and creativity of the people and encourages entrepreneurs and technological advancements. In addition, it plays an important role in the defense of economic and social progress and improves the income distribution.

According to Rob Lynes Director of British Council India, “ The Indian school education system is one of the largest and most complex in the world The complexity of the system stems from India’s need to maintain standard and uniformity, while giving scope for its diverse culture and heritage to grow and flourish across the length and breadth of the country. After independence India has worked hard to provide access to almost all its young people, but it has only just begun to focus on aspects of quality and seek to improve learning outcomes. At many academic institutions today, particularly those the concepts of, and possible differences between,

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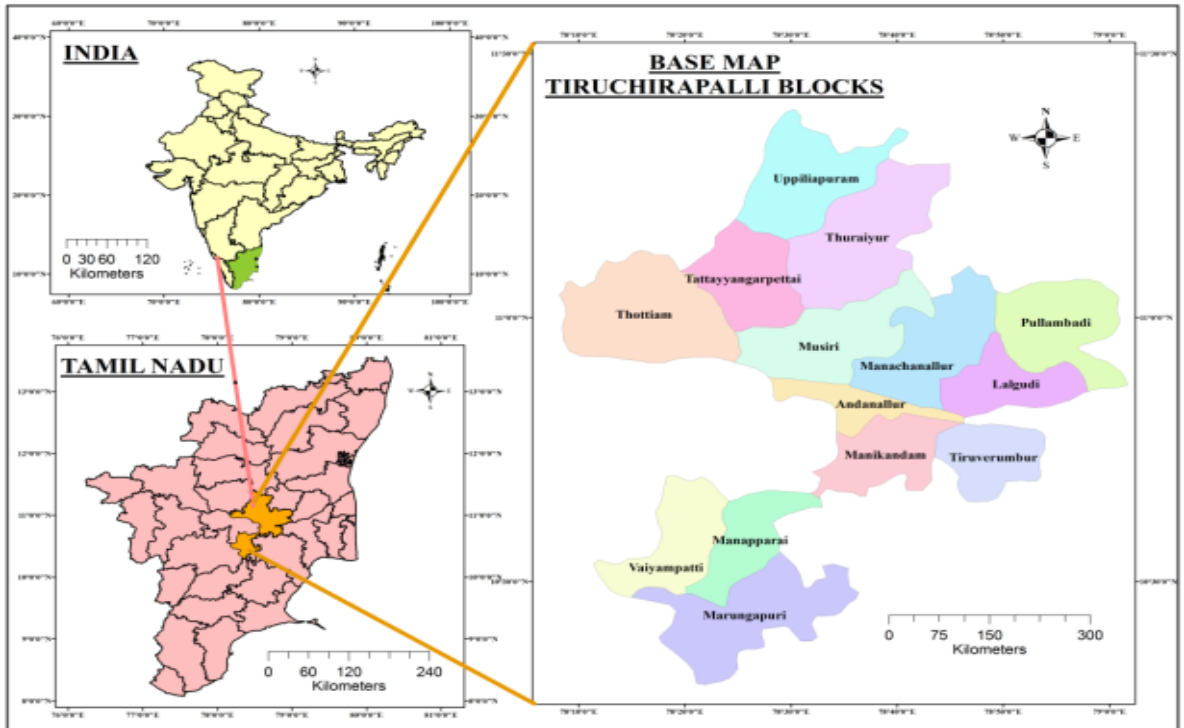


Fig.1: Base Map

“the scholarship of teaching and learning,” “scholarly teaching,” and “teaching as research” (Bernstein, 2008; 2008; Shulman & Hutchings, 1999; Trigwell, 2008). Instructors engaged in this debate hopefully would agree that they share a commitment to provide teaching that is (a) based on sound theory, (b) infused with current research findings, (c) experiential and contextualized, and (d) strengthened by collaborative input to facilitate and measure student learning. An integral component of this collaborative input is peer review. Peers are an under-used resource for instructors (Healey, 2008; Keig, 2000; Kynaston, 2007; Macfarlane, 2004).

Back ground of the study area

The present study area is an inland district located in the central segment of the state of Tamil Nadu. The study area lies between $10^{\circ} 15'$ and $11^{\circ} 12'$ North latitudes and $78^{\circ} 10'$ and $79^{\circ} 5'$ East longitudes

These study area are further divided into fourteen blocks namely Lalgudi, Pullambadi, Manachanallur, Manapparai, Marungapuri, Vaiyampatti, Musiri, Thattayangarpetti, Manikandam, Andhanallur, Thiruverambur, Thottiam, Thuraiyur and Uppiliapuram. The district is one of the privileged few to have the river Cauvery. One of the biggest rivers in south India and its main branch Coleroon too traverse through its land. The study area has a hot tropical climate compared to the adjoining coastal districts; the climate is hotter and drier in non-rainy season. The study area experienced an average temperature of 29°C . The maximum temperature of 32°C was recorded during the month of May, while the minimum temperature was recorded in the month of December (25°C). The annual rainfall in the study area accounted to about 6453mm. The maximum rainfall fell during the month of September and October. In 2011,

Tiruchirappalli had population of 2,722,290 of which male and female were 1,352,284 and 1,370,006 respectively. The Tiruchirappalli District Population Growth Rate is 12.57 percent in the population. In the density of Tiruchirappalli district for 2011 is 604 people per sq km Average literacy rate of Tiruchirappalli in 2011 were 83.23.

Aim and objective

To analysis the distribution of school education Institute and students gender at the Tiruchirappalli District.

- i. To analysis the distribution of the school education institute in the Tiruchirappalli district
Like that government, Aided, Private or Unaided
- ii. To analysis the number of students studying in class wise (primary, Middle, secondary and higher secondary)
- iii. To compare the gender wise students distribution

Data base and methodology

This study is mainly based on secondary data. Information about the education institution and the number of students studied was collected from the statistical office in Tiruchirappalli. In the current study, quantity and descriptive methods and cartographical techniques are used. Simple statistical calculations such as percentage work to study the school educational. Analysis is based on the graphical maps produced using the ArcGIS software.

Discussion and Result

With over 14 million schools and more than 230 million records, India is one of the largest and most complex school education systems in the world. There are four levels of school education in Tamil Nadu: Primary, Secondary, Secondary and Secondary School. The Indian Government, Primary Education Study, is referred to as Early Education in India before the age of fourteen. Children are given free of charge under the Free and Compulsory

Education Act of 2009 to children between the ages of 6 to 14 (I to VIII standard). Provided by education, public sector and private sector in India Control and Finance comes from three levels: Central, State, and Local (Private)

Distribution of schools

School education is important for socioeconomic development, which is an important indicator of human development India's literacy rate grew by 74.04 percent in 2011. India currently has the largest illiterate population in the world and the country stand well below the world average literacy rate of 84% The 2011 census shows that 2001 – 2011 decadal literacy growth of 92 percent, which is slower than the previous decade. Tamil Nadu is one of the most literate states in India The state performed reasonably in terms of literacy growth during the decade 2001 – 2011.

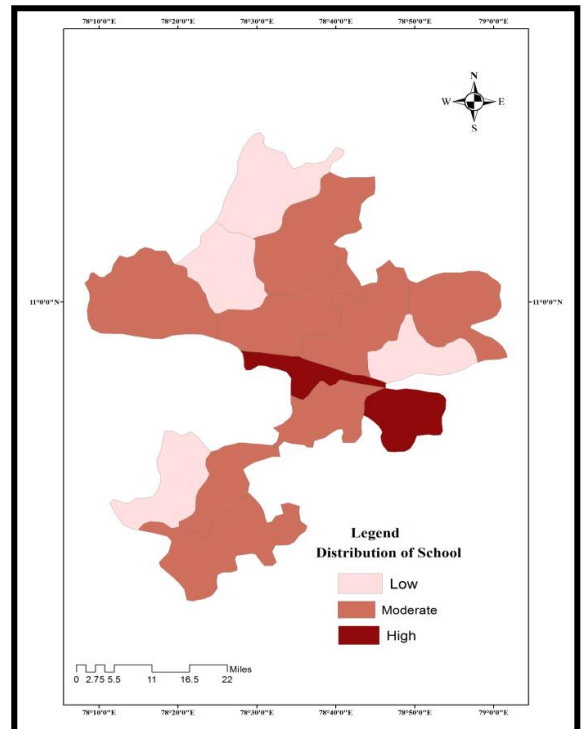


Fig.2: Distribution of schools

Fig.2, represents distribution of school at study area. The schools highly distributed in Andhanallur and Thiruverumbur. The moderate distributions are Thottiam, Marungapuri, Manapparai, Manikandam, Mannachanallur, Musiri, Pullambadi, Thuraiyur. The low distribution is marginal blocks at study area its Uppiliyapuram, Thathiengarpet, Lalgudi and Vaiyampatty.

Segmentation by Means of Ownership of Educational Institutions

Schools in India are owned either by the government (central/ state/ local government bodies) or by the private sector (individuals, trusts or societies). Schools can thus be segmented as:

autonomic organisations and are wholly financed by the government. Examples of these types of schools include state government schools, Kendriya Vidyalayas, Ashram schools, Navodaya Vidyalayas, Sainik Schools, Military schools, Air Force schools, and Naval schools, municipal committees, corporations, and etc.

The fig.3 represents distribution of government school classes percentages. The Lalgudi, Manapparai, Mannachanallur, Marungapuri, Pullambadi, Thiruverumbur, Thuraiyur and Vaiyampatty blocks high percentage of primary schools and middle schools moderate. This blocks low percentage comparing primary and middle in secondary and higher secondary school. The Manikandam, Musiri, Thathiengarpet, Thottiam and Uppiliyapuram blocks high percentage of primary and moderate secondary and higher secondary class and middle class schools is low comparing primary and middle.

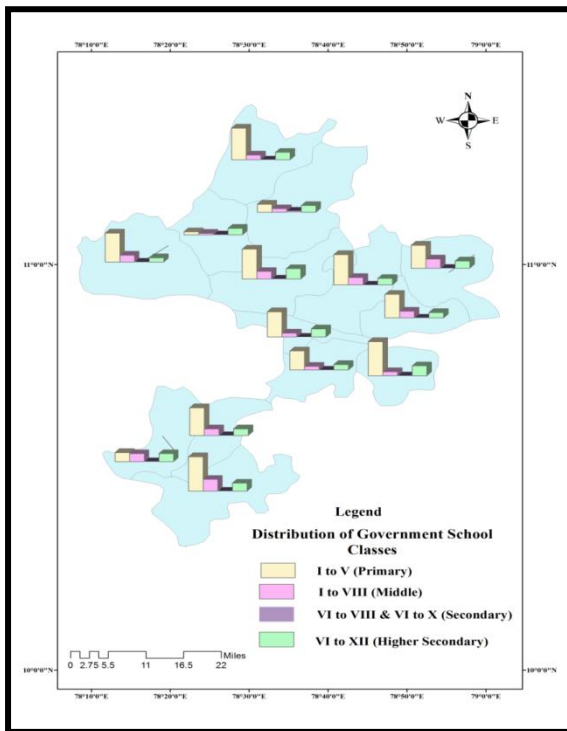


Fig.3: Distribution of government school and class

i. Government Educational Institutions:

These are run by the Central Government or state governments, public sector undertaking or

ii. Aided Institutions:

These are managed privately but receive regular maintenance grant from the government, local body or any other public authority. The rules and regulations followed here are same as that of the public schools. The curriculum, study materials, syllabus, examinations, etc for each class of education are done according to the government rules.

The fig.4 represents distribution of aided school from classes wise primary, middle, secondary and higher secondary classes. This block spatially highly distributed in higher secondary class school and second in middle and third in primary class.

iii. Private or Unaided Institutions:

These are managed by an individual or a private organisation and do not receive maintenance grant either from government, local body or any other

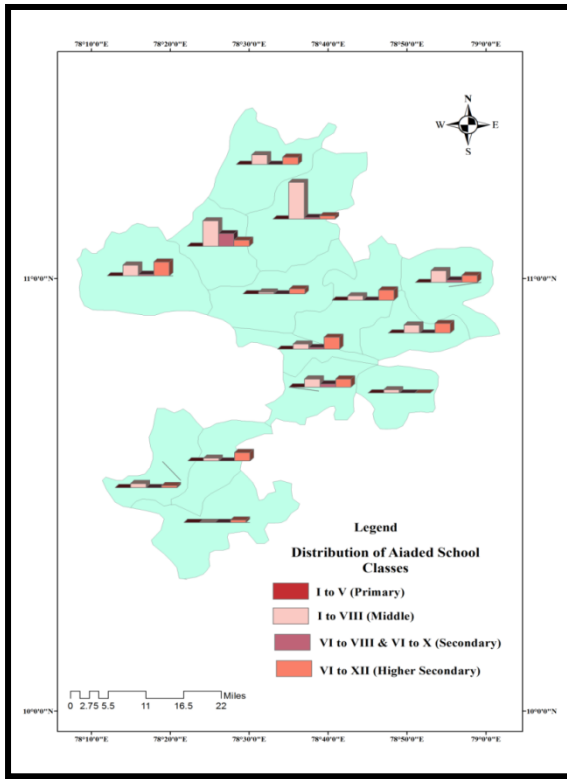


Fig.4: Distributed of aided schools and classes

public authority. The fee structure for the students may vary greatly from that of the government institutions. The students are admitted to these institutions according to some criteria (entrance examinations, interviews, etc) and it is totally under the control of the private management. These schools generally create their own curriculum and organize examinations for evaluating the student competency.

Fig.5 represents in distribution of unaided school from class wise like that primary secondary and higher secondary classes. The Andhanallur, Lalgudi, Manapparai, Manikandam, Mannachanallur, Musiri, Pullambadi, Tthathiengarpet, Thiruverumbur, Thuraiyur, Uppiliyapuram and vaiyampatty block high distributed in primary and secondary school. The middle classes schools are very low from this

block. The Thottiam, Marungapuri and Thottiam blocks primary and middle classes schools high comparing middle and Secondary schools.

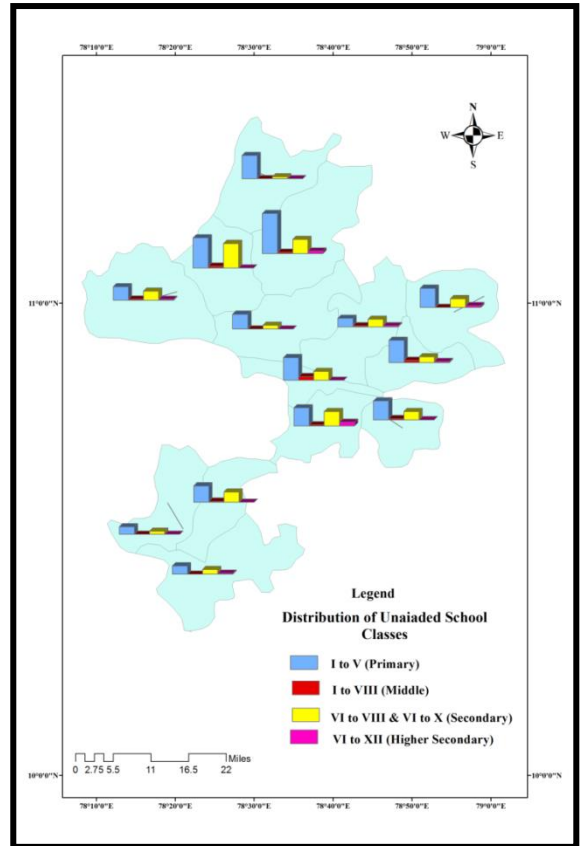


Fig.5: Distribution of unaided school & classes

Distribution of Students Enrolment

The structure of education in the state is based on the national level pattern with 12 years of schooling (10+2+3), consisting of eight years of elementary education, that is, five years of primary and three years of middle school education for the age groups of 6-11 and 11-14 years, respectively, followed by secondary and higher Secondary education of two years each besides two years of pre-primary education. The entry age in class 1 is 5+ Pre-primary classes form age group 3 to 4 The higher secondary school certificate enables pupils to pursue

studies either in universities or in colleges for higher education in general academic streams and in technical and professional courses.

i. Primary Level Students:

First to fifth standard/class/ grade is called primary education (for six- to ten-year-olds). The study future of the Society depends on the standard of primary education. Primary education has to be approached a lot of creatively wherever dedicated academics nurture young youngsters who will prepare themselves for the challenges of the long run.

percentage at Tiruchirappalli blocks. The Thuraiyur and Mannachanallur block distribution of student enrollment is low and high in Lalgudi, Manikandam, Vaiyampatty and other block Andhanallur, Manapparai, Marungapuri, Musiri, Pullambadi, Thathiengarpet, Thiruverumbur, Thottiam, Uppiliyapuram is moderate distribution. The gender gap is below one percentage at Andhanallur, Manikandam, Musiri and vaiyampatti blocks. The gender gap is above one percentage at Lalgudi, Mannachanallur, Manapparai, Marungapuri, Pullambadi, Thiruvarambur, Thottiyam, Thuraiyur, TPet and Uppiliyapuram blocks.

ii. Middle Level students: (Sixth to eighth standard (for 11- to14-year-olds))

At this stage the students have stepped or are about to step into adolescence. The Middle School curriculum is holistic as it concerns itself with fostering a culturally sensitive and socially responsible student who has strong communication skills, is confident and is an avid learner Socio-emotional skills are just as important as the student’s academic prowess. This philosophy allows our students to discover their academic strengths and interests. Besides cultivating more advanced academic skills, the Middle School curriculum offers students the opportunity to develop in their creative, physical, technical, and empathetic skills to ensure the development of a well-rounded individual.

The fig.7, represents, Distribution of middle level student’s enrolment in percentages at Tiruchirappalli blocks. The whole blocks middle class education institute is very low comparing other. The Andhanallur, Thottiyam, Thuraiyur and TPet blocks boys students high and Andhanallur, Lalgudi, Mannachanallur, Manikandam, Manapparai, Marungapuri, Musiri, Pullambadi, Thiruvarambur,

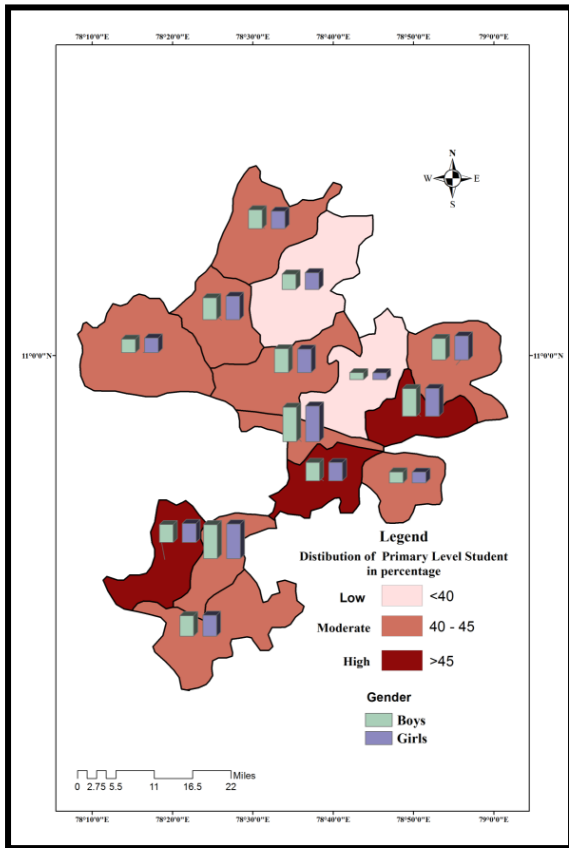


Fig.6: Distribution of primary schools students enrolment

Fig.6 represents, distribution of primary level students enrolment in percentage and gender

Uppiliyapuram and vaiyampatti blocks girls enrolment is high comparing boys.

developed nations In fact, attempts to emulate educational systems that have worked elsewhere may impede economic and social progress in a less-developed nation.

The distribution of secondary and higher secondary school student enrolment percentage is low in Tiruchirappalli blocks. The Lalgudi, Musiri, Uppiliyapuram and vaiyampatti block student enrolment gender gap is these girls enrolment high in boys The enrolment differentiation above one percentage is Andhanallur, Mannachanallur, Manikandam, Manaparai, Pullambadi, Thuraiyur and TPet blocks. The enrolment gender gap below one percentage it is Marungapuri, Thiruvarambur and Thottiyam blocks (Fig. 8).

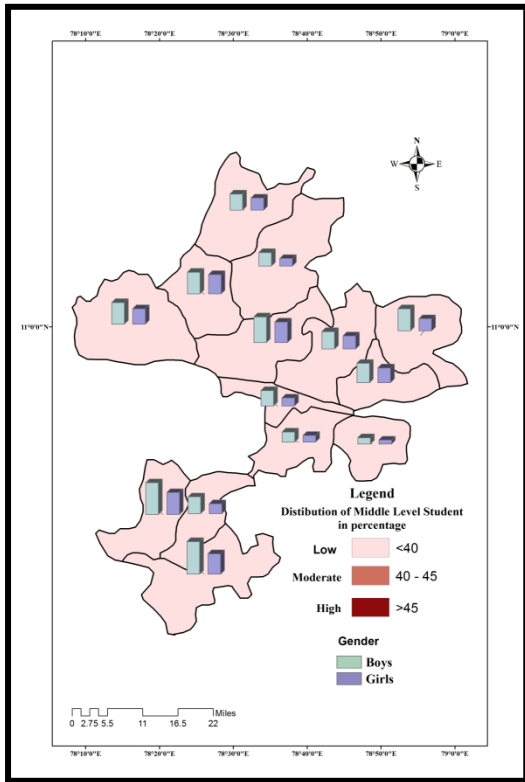


Fig.7: Distribution of middle schools students enrolment

iii. Secondary and Higher secondary Level Students: (8th and 12th standard/ class/grade (for 14- to 18-year olds))

Secondary and higher secondary level education is informally regarded as the education children receive during their teenage years, although the average ages of entrance and exit vary considerably among various nations. The objective is to identify key aspects of secondary education that may be essential contributors to national self-sufficiency. There is danger in examining and evaluating national education systems in less-developed nations because it is too easy to reach the conclusion that they should mimic the education systems of

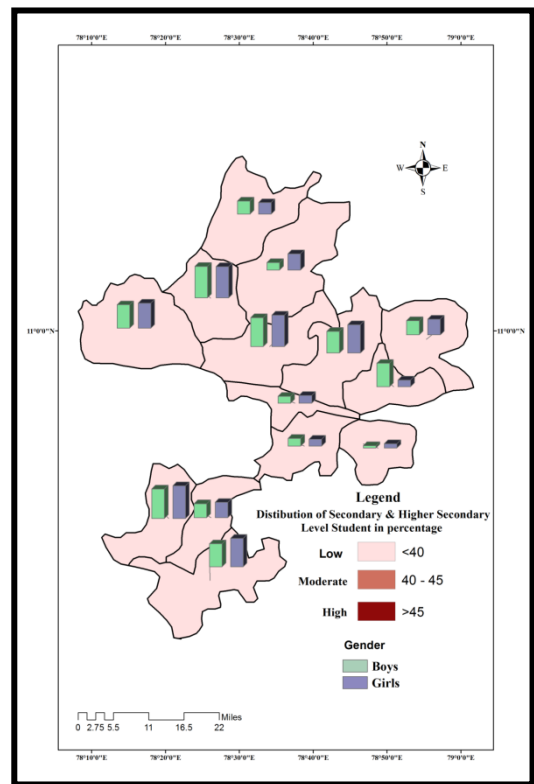


Fig.8: Distribution of secondary & higher secondary schools students enrolment

Conclusion

The present study analysis the distribution of school education Institute and students gender at the Tiruchirappalli District. The Education teaches children to analyse information and to utilize this acquired knowledge Welch (1970) argues that education increases the worker's speed and quality due to increased knowledge and understanding of the specific tasks within the context of a larger firm structure. The regional school distribution is much higher in the centre of the research area. All the blocks located in government primary school, middle and higher and higher secondary schools. This blocks high in primary schools. All the blocks located in government primary school, medium and high and high schools. It is high in primary schools. Aided school is distributed among the secondary, middle and secondary and secondary schools. The primary student enrolment distribution is absolute blocks and gender distribution is 1:3. The middle, Secondary and Higher secondary school distribution is low in primary school enrolment and gender distribution ratio is 1:4. Further this block started more middle, secondary and higher secondary school start automatically rise student enrolment and it is improves the value and prominence of one's life, a good education breakdown from poverty. By obtaining a college degree, you can satisfy the work satisfaction You can buy a nice home, dress, food, and other needs because of your salary.

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Community Perception on Climate Variability and Related Water Issues at Southern Part of Rajnagar Block of Kendrapara District, Odisha

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Prof. (Dr.) Kabir Mohan Sethy

Abstract

Community level perception on climate variability and related issues is needed to be discussed while talking about climate change and development of a region. This study focuses on the coastal block of Kendrapara district in Odisha. The study was conducted through semi-structured interview on 14 gram panchayats of Rajnagar block. Water sample has been collected from various tube well for quality testing. The objective of this study is to investigate communities' dependency on water resource for specific usage and the quality of drinking water, which is directly related to climatic variability. The study reveals that 42% of the respondent thinks the effects of adverse climate impact lies upon 'reduced water availability, health issues and impact on agricultural production'. 28% of the respondent reported the available water is not clean, and 18% expressed their view that it is salty. With water quality assessment it has been found that the views of the respondent were true facts. The worst affected villages are Ostia, Koilipur, and Brahmansahi. In this research paper qualitative as well as quantitative data has been statistically interpreted to obtain the most appropriate result about the present scenario of water issues of the coastal communities of Rajnagar block.

Keywords: Climate Variability; Community's Perception; Water Availability; Water Quality Assessment.

1. Introduction

Climate Change and its impact is a common phenomenon not only to any specific study area but also it is a threat to the whole world today. Climate change is expected to affect coastal communities around the world, many of which are already considered vulnerable to ongoing climatic variability (4th Assessment Report of Intergovernmental Panel on Climate Change (IPCCC), 2001).

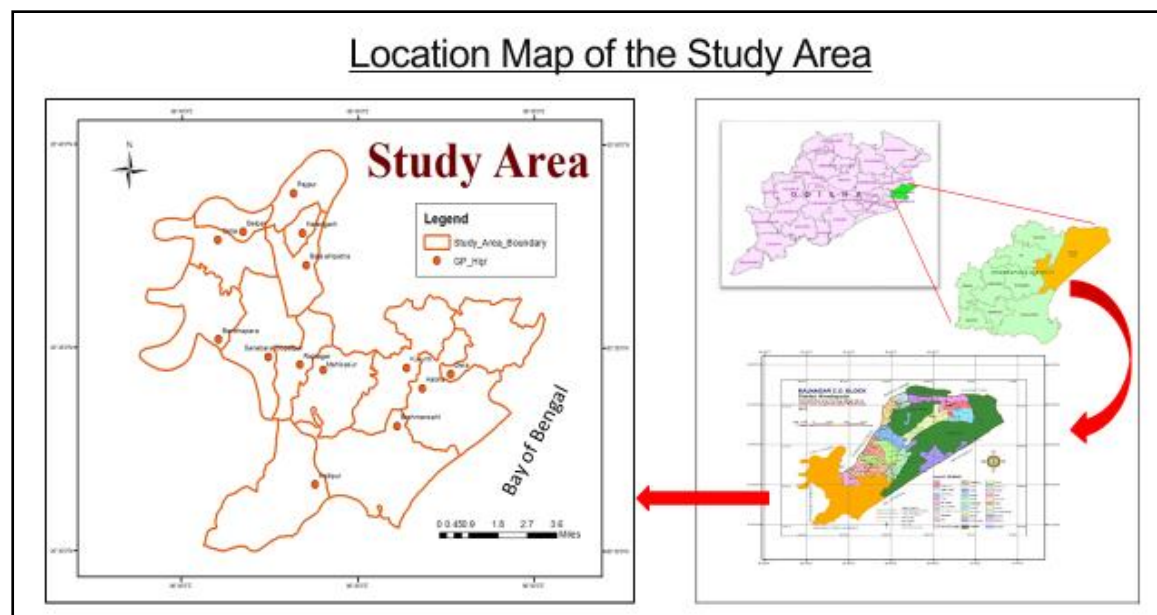
The tremendous importance of water in human life necessitates the understanding of how any change in global climate could affect regional water availability. Thus there is a necessity for understanding community perception about climate change and its linkage with existing water issues as they are common stakeholders suffering from the adverse effects of climate change.

Kendrapara district, in the east coast of Odisha, is one of the worst victims of flood and is vulnerable to both excess of water during monsoon and deficit during pre-monsoon. As a consequence this area is facing various kind of water resource related issues by which community livelihoods are getting affected. The study was undertaken at southern part of Rajnagar block of Kendrapara district of Odisha. Rajnagar Block is located along the western coast of Bay of Bengal. 14 Gram panchayat has been selected to carry out the study. Rajnagar Block lies

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Map-1

between $20^{\circ}30'5''$ to $20^{\circ}47'34''$ North latitudes and $86^{\circ}38'44''$ to $87^{\circ}5'36''$ East longitudes.

The main objective of this paper is to explore the community perception of climate change and to address climate change related water issues at the study area.

2. Methodology

Perceptions on climate variability of the community is a qualitative kind of research. It is necessary to get a complex, detailed understanding of the issue (Creswell, 2007). Responses has been obtained by the primary data collection of 85 randomly selected household of 37villages under 14 gram panchayats in the southern part of Rajnagar block. The Response rate of the survey respondents was 100 percent and no respondent dropped out after starting questionnaire survey. Relevant climatic data like rainfall, temperature, natural calamities, that occurred in the area were obtained from the concerned departments such as Indian Meteorological Department and State Government

reports of Odisha. Information about running tub wells and piped water supply has been collected from Rural Water Supply and Sanitation Department. Water sample was collected from 14 location during pre-monsoon period under 14 GPs for testing. Five parameters have been selected for testing and samples have been tested in central water commission water quality laboratory eastern rivers division Bhubaneswar. The standards for drinking purposes recommended by IS 10500 (Indian Standards, 2012) have been considered.

3. Result and Discussions

3.1. Responses of Respondents

Most of the Respondents perceived that the variability in climate has occurred in last ten years. From the record of natural hazards it has been observed that Rajnagar block faced a lot of natural calamities especially flood over past as well as recent years (Table 2).Over 96 % of the total respondents reported that number of rainy days had drastically decreased during rainy season compared

to ten years ago. They also reported that summers are getting hot as compared to previous years

Table-1: Perceptions of Rainfall and Temperature Compared to Last Ten Years:

Climate Change Perception	Perception	Household	%
Duration (days) of Rainy Season decreased	Yes	82	96.47%
	Maybe	2	2.35%
	No	1	1.18%
Duration (days) of Rainy Season decreased Total		85	100.00%
Temp Increased during Summer	Yes	82	96.47%
	Maybe	1	1.18%
	No	2	2.35%
Temp Increased during Summer Total		85	100.00%

Source: Primary questionnaire survey of house hold, 2017

Table-2: List of Related Extreme Climatic Events Occurred in The Study Area:

Type of Disaster	Year of Occurrence	Month of Occurrence
Flood	1992	August
	1999	October
	2001	July
	2003	July-August
	2006	August
	2008	September
	2009	September
Cyclone	2011	August
	1967	October
	1971	October
	1982	August
	1999	October
	2013	October
2014	October	
Heavy Rainfall	1995	May
Unseasonal Rain	2010	December

Source: RajnagarAutomatic Rain Recording Station

(Table-1). This indicates warmer air in summer which causing faster evaporation resulting to dryness in soils. But intense rainfall with heavy downpours leading to more occurrence of Flood.

They identified Climate change as a serious issue for their daily life, Cultivation, health and overall livelihood 31% respondents found cyclone as a severe threat to their life (Table-3).

Survey respondents were also asked to report their overall perception of their concern about extreme climatic events induced diseases and health problems related to reduced water availability and Quality 42 % of respondent perceived their concern about reduced water availability, Health issues, Impacts on agricultural production as the adverse impact of climate change (Table-4).

Table-3: Perceptions of Natural Hazard Scenario

Natural Disaster	Low	%	Moderate	%	High	%	Severe	%	Grand Total	%
Cyclone	2	2%	36	42%	26	31%	21	25%	85	100%
Flood	36	42%	14	16%	11	13%	24	28%	85	100%
Tidal Surge	28	33%	30	35%	20	24%	7	8%	85	100%

Source: Primary questionnaire survey of house hold, 2017

Table-4: Important Concerns of Respondents about Effects of Adverse Climate Impact

Important Concerns of Respondents about Effects of Adverse Climate Impact	HH No	%
Health issues	3	4%
Health issues, Impacts on agricultural production	6	7%
Health issues, Impacts on agricultural production, Rise in sea level	1	1%
Impacts on agricultural production	1	1%
Reduced water availability	2	2%
Reduced water availability, Health issues	14	16%
Reduced water availability, Health issues, Impacts on agricultural production	36	42%
Reduced water availability, Health issues, Impacts on agricultural production, Increased no of severe weather events	1	1%
Reduced water availability, Health issues, Impacts on agricultural production, Rise in sea level	19	22%
Reduced water availability, Health issues, Rise in sea level	1	1%
Reduced water availability, Impacts on agricultural production, Rise in sea level	1	1%
Grand Total	85	100%

Source: Primary questionnaire survey of house hold, 2017

3.2. Water Dependency & Availability

River Brahmani and Baitarani along with their distributaries from the drainage system in and around the block. 13 GPs are surrounded by distributaries of Brahmani River (Table 5). As 48 percent and 16 percent population of the total respondent were cultivators and agricultural labours the livelihood of coastal community are supposed to highly dependent upon surface water system (Rivers) for agriculture. But due to erratic Rainfall pattern and Sea water intrusion they do not prefer to use River water for agriculture. 79 percent of the total households depend on rain water and only 15 percent uses River water for agriculture (Table 6).

Table-5: Surface water resource

Name of the GPs	Name of the Rivers Flowing
Rajnagar	Brahamani, Hansua
Mahisasura	Hansua
Sanabada Gopalpur	Hansua
Balisahipatna	Brahamani, Kani
Keradagarh	Baitarani, Kani, Hansua
Rajpur	Brahamani,
Ostia	Brahamani,
Belpal	Brahamani, Hansua
Bandhapada	Brahamani, Kani
Dera	-
Hatina	-
Brahmansahi	Baruni
Kurunti	-
Koilipur	Gobari, Luna

[Source: Primary field survey]

Table-6: Source of water for different usage:

Source of Water	Agriculture	%	Domestic and household use	%	Fisheries	%	Not Dependent	%	Grand Total	%
Open well	0	0%	5	6%	0	0%	80	94%	85	100%
Pond	0	0%	30	35%	7	8%	48	56%	85	100%
Rain water	67	79%	0	0%	0	0%	18	21%	85	100%
River	13	15%	16	19%	6	7%	50	59%	85	100%
Tube well	0	0%	84	99%	0	0%	1	1%	85	100%

[Source: Primary questionnaire survey of house hold]

3.3. Water Quality Issues

The coastal community of Rajnagar block were living in a saline marshy tract along the coast. According to the directorate of Ground Water Survey & Investigation Bhubaneswar, Rajnagar block has full part of saline aquifers. Hence the ground water scenario being negative due to salinity and recent alteration of weather condition

aggravates this situation because the upper layer of fresh water is dried up which causes salty and dilution water during summer. Most of the household uses tube well for drinking purpose but 33 % household reported that the water was not clean, 21 percent reported the water was salty (Table-7).

Table-7: Household's Opinion on Tube Well Water Source:

Household's Opinion	Count of Household No	%
Difficult to access	10	12%
Difficult to access, Salty	1	1%
No problem	9	11%
Not clean	28	33%
Not clean, Difficult to access	12	14%
Not clean, Difficult to access, Salty	5	6%
Not clean, Salty	2	2%
Salty	18	21%
Grand Total	85	100%

Source: Primary questionnaire survey of house hold, 2017

3.4. Water Quality Assessment:

Water is essential to sustain life and a satisfactory (adequate, safe and accessible) supply must be available for all (Guidelines for drinking-water Quality, 2004). According to the primary survey it has been noticed that community of the study area are being suffered from very low quality of water

and it has been degraded by the frequent changes in climatic phenomena. For the general assessment of water quality to check suitability of water for drinking and domestic use of the area water quality testing has been done in this study. All water sample has been collected from shallow tube wells of 14 different site of respective gram panchayats. It has

been taken during June 2017 were analysed for five general physical parameters and the test has been done in Central Water Commission, water quality laboratory, eastern rivers division Bhubaneswar.

Table-8: General Water Parameters for Quality Assessment:

ID	Name of the GPs	Latitude (N)	Longitude (E)	Electronic Conductivity	TDS	Turbidity	pH	TH CaCo3
1	Ostia	20°37'0663"N	86°42'2607"E	2970	1657	8.60	6.72	140.1
2	Keradgarh	20°37'4712"N	86°43'1055"E	1425	775	4.50	7.80	128.1
3	Rajpur	20°38'2675"N	86°42'5265"E	1250	676	3.70	7.25	157.7
4	Bandhapada	20°35'3956"N	86°41'1334"E	1313	711	4.10	7.18	228.2
5	Koilipur	20°31'2271"N	86°42'4292"E	2672	1486	6.90	7.20	168.1
6	Balisahipatna	20°37'1048"N	86°42'4874"E	1144	615	3.20	7.20	300.2
7	Hatina	20°32'3897"N	86°47'1080"E	1370	744	4.80	7.25	256.2
8	Rajnagar	20°34'3347"N	86°43'0710"E	1197	645	3.90	7.23	232.2
9	Kurunti	20°34'2515"N	86°44'1260"E	1060	568	2.90	7.30	248.2
10	Mahisasur	20°34'0098"N	86°45'0363"E	1030	551	2.60	7.80	148.1
11	Dera	20°34'5356"N	86°49'1439"E	1500	818	5.10	7.50	172.1
12	Brahmansahi	20°31'3457"N	86°45'5278"E	2995	1671	9.1	7.90	255.3
13	Sanabada Gopalpur	20°35'2804"N	86°42'0785"E	1254	678	3.2	7.33	165
14	Belpal	20°37'4469"N	86°41'4225"E	2159	1125	3.4	7.1	176

Source: Primary field survey, June, 2017

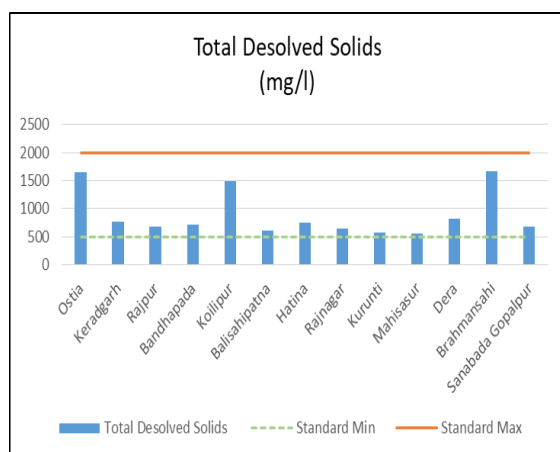


Fig.1: Total dissolved solids

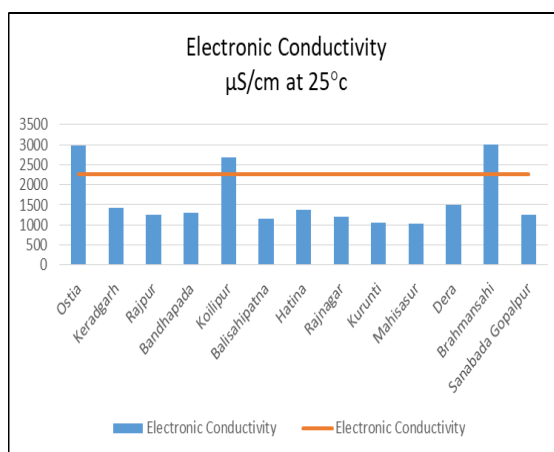


Fig.2: Electrical Conductivity at 25° C

All the parameters' permissible limits of drinking water are not same for different agencies i.e. USEPA, WHO, IS. The table 8 shows the deferent tolerance limits of general drinking water parameters from which it can be observed the sample results. The resultshowing TDS and

conductivity of three sites named Ostia, Koilipur and Brahmansahi has crossed the tolerance limit (Fig 1 & 2). It indicates higher salinity level in ground water. High levels of salt concentration in freshwater can cause problems for aquatic ecosystems and human uses.

Table-9: Standards for Quality of Drinking Water

Parameters	WHO	ISI Permissible (acceptable)
pH	65-85	65-85
EC	1400	-
TDS (mg/l)	1000	2000
Calcium (mg/L)	200	200 (75)
Magnesium (mg/L)	50	100 (30)

4. Findings and Conclusion

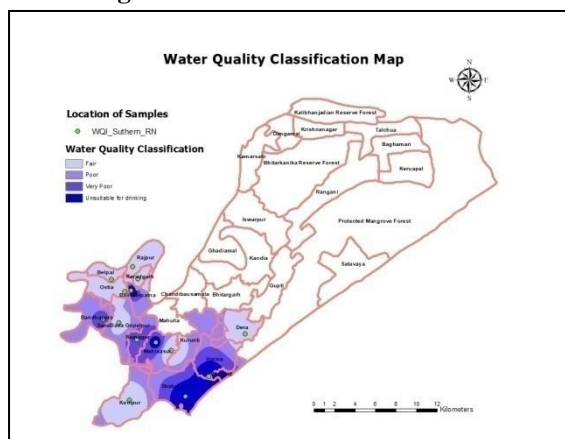


Fig.3

From this study it has been observed that 82% of the respondent of the study area believe that number of rainy days decreased during rainy season and likewise they also think that the temperature has increased during summer because of which they are suffering from different sets of problem like water issues (deficiency of water, low water quality) and also crop loss and change in biodiversity. According to 42% of the respondent the effects of adverse climate impact lies upon ‘reduced water availability, health issues and impact on agricultural production’ and 22% of the respondent believe it also causes rise in sea level. This also leads to salt water intrusion which further creates loss in crop production and increase salinity of the water. After getting the water samples and making a quality assessment it has been found that the views of the respondent were true

facts. The worst affected villages are Ostia, Koilipur, and Brahmansahi.

Still there is one question would be arisen with respect to the Community perception on climate variability and related water issues that, “which information is relevant for the related study?” Often stakeholder’s perception are based on rather hypothetical issues. Sometimes many stakeholders with different opinions and perceptions are difficult to handle. But it is also be rational to trust in local knowledge and individual experience rather than in science to address the climate change effects in a particular region to raise awareness and to increase the quality of decision making process. Involving perception of local respondents often come up with some unique strategical measures and points of action. However, this study concludes that the use of available information of human perception on climate change and water issues will allow researchers and policy makers to design and implement appropriate adaptation strategies for vulnerable areas affected from climate change.

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State of Urban - Rural Cleavage in Electoral Preferences Caused by Socio-Political Situation in Patna, India

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Abstract

The electoral choice of individuals is modified by a wide range of social, economic, political, institutional legislative and psychological factors. Indian elections are mind bogglingly complex. The spatial pattern of electoral preferences based upon the various socio-political background creates a space for geographical research. Most societies are split along some fault lines which shapes political attitude and perception. There are several dimensions along which the social fault lines or cleaves are manifested. Such as social class, religion, gender, occupation, age etc. One of the classic cleavages is framed by urban- rural conflict line.

City dwellers are usually politically different from countryside people in terms of source of income, living condition, education and social and economic priorities. The characteristics of rural- urban cleavage is to be evaluated in present paper using example of Patna district located in eastern India. The time period of upcoming analysis is from 2005 to 2015.

The objective of the study is—(i) To find out how residential status of a voter predicts her political attitude, (ii) To study motivational and situational constraints of voting among women in urban, semi- urban and rural areas. The research is based upon the field survey, primary data and

secondary data as well as newspaper reports and articles. Apart from that data from Election Commission of India, District Election Portal itself has been used to enrich the work.

Keywords: Rural- Urban, Spatial, Cleaves, Electoral Preferences, Political Attitude

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Introduction

The electoral choice of individuals is modified by a wide range of social, economic, political, institutional legislative and psychological factors. Indian elections are mind bogglingly complex. The spatial pattern of electoral preferences based upon the various socio-political backgrounds creates a space for geographical research. Most societies are split along some fault lines which shapes political attitude and perception. There are several dimensions along which the social fault lines or cleaves are manifested. Such as social class, religion, gender, occupation, age etc. One of the classic cleavages is framed by urban- rural conflict line.

City dwellers are usually politically different from countryside people in terms of source of income, living condition, education and social and economic priorities. The characteristic of rural-urban cleavage is to be evaluated in present paper

using example of Patna district located in eastern India. The time period of upcoming analysis is from 2005 to 2015. Indians in urban and rural communities have different views when it comes to social and political issues.

There have been studies on the geography of election, voting behavior, political consciousness of voters in different parts of India. Amani in 1970 discussed the regional pattern of voting results in Haryana. He had also studied the regional aspects of the voting result of Uttar Pradesh by using a regional relational approach. Sharma in 1980 discussed the problems of voting behavior in India. He used z-score, factor analysis and regression methods for the study of election studies. Dikshit and Giri (1982) examined the changing nature of spatial pattern of the parliamentary voting results in India from 1951 to 1982. Hussain and Mirin 1983 identified the voting determinants for 1982 Assembly elections in Jammu and Kashmir. The study was based on regional structural approach. Sinha(1985) tried to find out the level of competition among political parties of India. Dikshit and Singh(1992) emanated friend and neighbor influence in Indian elections. He said that as distance of residence of voter's increases from the residence of candidates there is decrease in political affirmation. Devi and Lakshmi (2005) studied political empowerment of women in Indian legislature. She suggested that women representatives should form 'critical mass' so as to act as a pressure group in the legislature. They can also raise voice on crucial concern to women such as contraception, abortion, violence against women, gender discrimination, maternity leave, child care etc. M.M.S. Negi (2011) explained the voting attitude of women in Uttarakhand with special reference to Garhwal. According to him political awareness plays an important role in forming and shaping political attitudes such as those related to voting. Ali & Lin, 2012 said that understanding why

people vote is fundamental to the theory and practice of democracy. The objective of the study is- (i) to find out how geographical locality of a voter predicts her political attitude, (ii) to study motivational and situational constraints of voting among women in urban, semi-urban and rural areas.

Geographical Profile of the Study Area

For the present study, Patna district has been selected as the study area. It is the capital of the state which makes it one of the important districts among the entire 28 districts of Bihar. The latitudinal and longitudinal extents of this district are 25° 12' N to 25° 34' N and 84° 32' E to 86° 4' E respectively. Patna district is also known as the heartland of Bihar, therefore, who rules Patna, commands the entire state of Bihar and even influences the national politics. There are fourteen assembly constituencies in Patna district. These are Maner, Bikram, Bankipur, Patna Sahib, Danapur, Kumhrar, Paliganj, Mokama, Digha, Fatuha, Masauri, Bankipur, Phulwari and Barh. The district is bounded by the river Son on the west, on the north by the Ganga River and on the south by Nalanda, Arwal and Jahanabad districts. On the east the district is bordered by Begusarai and partly by Lakhisarai.

Methodology

For a scientific and a valid conclusion, pre field study, field study and post field study has been conducted. Pre-Field Study includes library work, data collection from Election Commission of India, Census of India and the Department of Statistics. Newspapers (Times of India, The Hindu, DainakJagran and Hindustan) are also a part of pre field survey for the study. Data collection has been arranged in order for statistical and cartographic treatment. Questionnaire has been prepared on the basis of the pattern which has emerged after the processing of the data through statistical and cartographic methods.

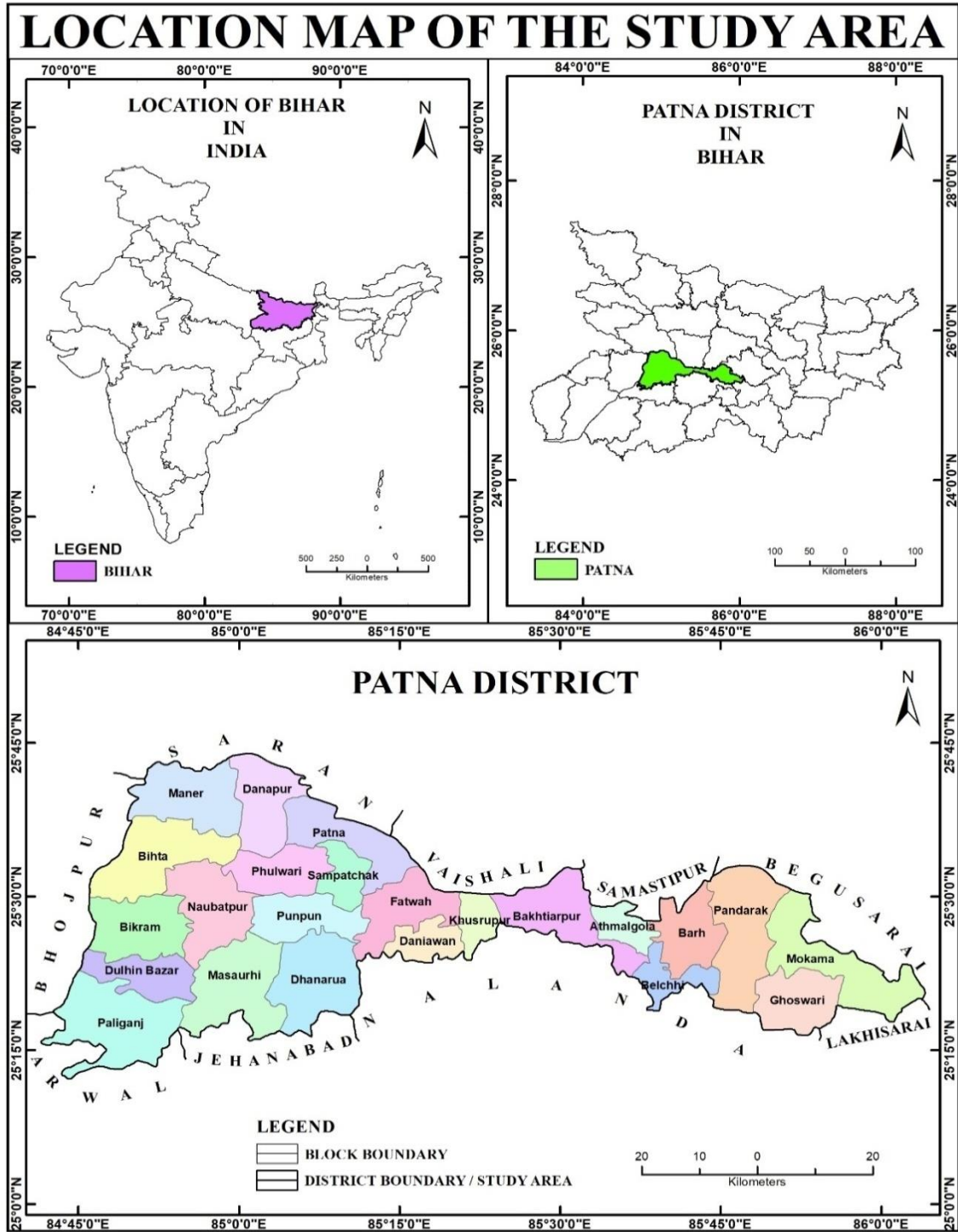


Fig.1: Location Map

In field Survey primary data collection with the help of questionnaire regarding their voting perception has been done. Respondents have been selected with the help of stratified random sampling technique. Tabulation and compilation of data collected through primary field survey has been done in order to find an appropriate result in post field survey. Statistical and mathematical treatment of data has been done and the result so obtained is represented by explanations and suitable diagrams using cartographic techniques.

This study is based on primary data. Extensive field surveys have been done to generate this primary data. A questionnaire schedule was prepared to acquire this data. A total of nine eighty six samples have been used. 52.2 percent respondents are from rural areas, followed by 21.8 percent from semi-urban and 26.0 percent were urban residents.

Urban -Rural Conflict

There are several dimensions along which the social fault lines are manifested. Such as social class, religion, gender, occupation, age etc. One of the classic differences in electoral preference is framed by urban- rural political situation. Tarrow, (1971) stated that among many cleavages that score the political landscape of modern nations, the gap between the urban and rural society is perhaps the most intriguing and the least understood. City dwellers are usually politically different from countryside people in terms of source of income, living condition, education and social and economic priorities. The political concerns of urban people are different from the interest of rural residents (Robeck1970).

The ongoing urbanization in India created a new landscape of semi-urban population as they don't fit in the rubrics of urban or rural population. Pratt, 1987, said "The semi urban life style is markedly different from that of urban or rural areas, as its

residents were more often middle class, many becoming homogeneous for the first time."

The assembly constituencies are classified as **urban, semi- urban and ruralsegments**. Digha, Bankipur, Kumhrar and Patna Sahib are urban assembly constituency. Danapur, Phulwari Sharif and Maner are semi -urban assembly constituency. Fatuha, Paliganj, Mokama, Bikram, Masaurhi, Barh and Bakhtiarpur are rural assembly constituency.

From the Table 1 and Fig.1, it can be seen that there is significant association between place of residence and choice of a particular party to vote for is observed among the studied population. A statistically significantly increasing trend is observed towards BJP (Bharatiya Janta Party), while a declining trend is observed towards INC (Indian National Congress) in comparison of assembly election held in 2005 February to 2015 assembly election among those who have respondent about their voting pattern during these elections.

In 2005 February & 2005 October election only 29 percent (10/256) urban voters had voted for BJP while in 2010 it is increased to 10 percent and 12 percent in 2015 election According to Falcao, 2009 urban India vote more for BJP giving BJP an identity of being a party of urban interest.

In the election held in 2005 February the voting percentage among urban voters voted for JD (U) (Janta Dal United) is observed as 105 percent, followed by 109 percent in 2005 Oct, 105 percent in 2010 and in 2015 election Among rural respondent the voting share in 2005 February election is 107 percent, followed by 105 percent in 2005 October election, 128 percent in 2010 and 105 percent in 2015 election A significant observation is that among the rural population RJD (Rashtriya Janta Dal) is a better choice to vote Although a decreasing trend is observed In 2005 Feb election the voting

share for RJD is 151 percent followed by 136 percent in 2005 October & February assembly elections, 126 percent in 2010 election. Whereas for INC it is observed that in 2005 February election

they are able to get 112 percent urban voters but later on in 2005 October the voting percentage has decreased to 102 percent and subsequently 62 percent in 2010 and 55 percent in 2015 election.

Table-1

Overall		Rural	Semi Urban	Urban	Total	Chi Value	sig
		515 (52.2%)	215 (21.8%)	256 (26.0%)	986 (100%)		
Assembly Election 2015	Not Answered	255 (39.5%)	133 (67%)	153 (60.2%)	552 (56.1%)	52.35	<0.0001
	BJP	82 (15.9%)	6 (2.8%)	22 (12.5%)	120 (12.2%)		
	INC	13 (2.7%)	10 (3.7%)	13 (5.5%)	28 (2.9%)		
	JD(U)	53 (10.5%)	27 (12.6%)	27 (10.5%)	108 (11%)		
	RJD	70 (12%)	20 (9.2%)	25 (9.8%)	115 (11.7%)		
	OTHERS	30 (7.8%)	8 (2.7%)	3 (1.6%)	52 (5.2%)		
Assembly Election 2010	Not Answered	218 (61.7%)	157 (72%)	163 (63.1%)	629 (63.8%)	50.62	<0.0001
	BJP	9 (1.7%)	5 (2.2%)	22 (9%)	27 (2.8%)		
	INC	19 (2.7%)	12 (5.6%)	16 (6.2%)	37 (3.8%)		
	JD(U)	66 (12.8%)	19 (8.8%)	27 (10.5%)	112 (11.3%)		
	RJD	75 (13.6%)	18 (8.3%)	22 (8.6%)	115 (11.7%)		
	OTHERS	28 (5.3%)	3 (1.9%)	3 (1.6%)	26 (2.7%)		
Assembly Election October 2005	Not Answered	228 (62.7%)	166 (77.2%)	167 (65.2%)	661 (67%)	53.99	<0.0001
	BJP	9 (1.7%)	3 (1.9%)	10 (2.9%)	22 (2.2%)		
	INC	17 (2.2%)	8 (2.7%)	26 (10.2%)	51 (5.2%)		
	JD(U)	53 (10.5%)	19 (8.8%)	28 (10.9%)	101 (10.2%)		
	RJD	75 (13.6%)	18 (8.3%)	22 (8.6%)	115 (11.7%)		
	OTHERS	22 (6.2%)	0 (0%)	2 (1.2%)	25 (2.5%)		
Assembly Election FEB, 2005	Not Answered	225 (62.1%)	169 (78.6%)	176 (68.8%)	670 (68%)	77.39	<0.0001
	BJP	9 (1.7%)	1 (0.5%)	10 (2.9%)	20 (2%)		
	INC	16 (2.1%)	8 (2.7%)	29 (11.2%)	52 (5.3%)		
	JD(U)	55 (10.7%)	18 (8.3%)	27 (10.5%)	100 (10.1%)		
	RJD	78 (15.1%)	19 (8.8%)	10 (2.9%)	107 (10.9%)		
	OTHERS	22 (6.2%)	0 (0%)	3 (1.6%)	26 (2.7%)		

Source: Sample Survey, 2018

Motivational Constraints

Banerjee (2017) said that elections are not only cultural but also a moral event. Individuals come to vote even though one vote is immensely small, but it has immense value. The quality of democratic choice depends on the voter's motivation. If voters

are motivated, voting may result in smart choices because of information aggregation.

The major motivational constraints which come in the path of electoral system in India are: criminalization of politics, poll violence, and booth capturing etc. (Kaur 2012). The quality of democratic choice critically depends on voter's

motivation. If voters are motivated, voting may result in smart choices because of information aggregation. According to Table number two 30.1 percent (295/986) female has faced motivational constraints compared to 59.9 percent who did not face any motivational constrains. Motivational constraints include lack of education, not liking the candidates, no faith on political parties, dissatisfaction from the government and political apathy etc.

Table-2: Motivational Constraints among Female Voters of Patna District

Motivational Constraints	Urban	Semi-Urban	Rural	Total
No Constraints	119 (36.5%)	112 (52.6%)	259 (69.7%)	591 (59.9%)
Constraints	127 (52.5%)	102 (37.3%)	156 (20.2%)	295 (30.1%)

Source: Sample Survey, 2018

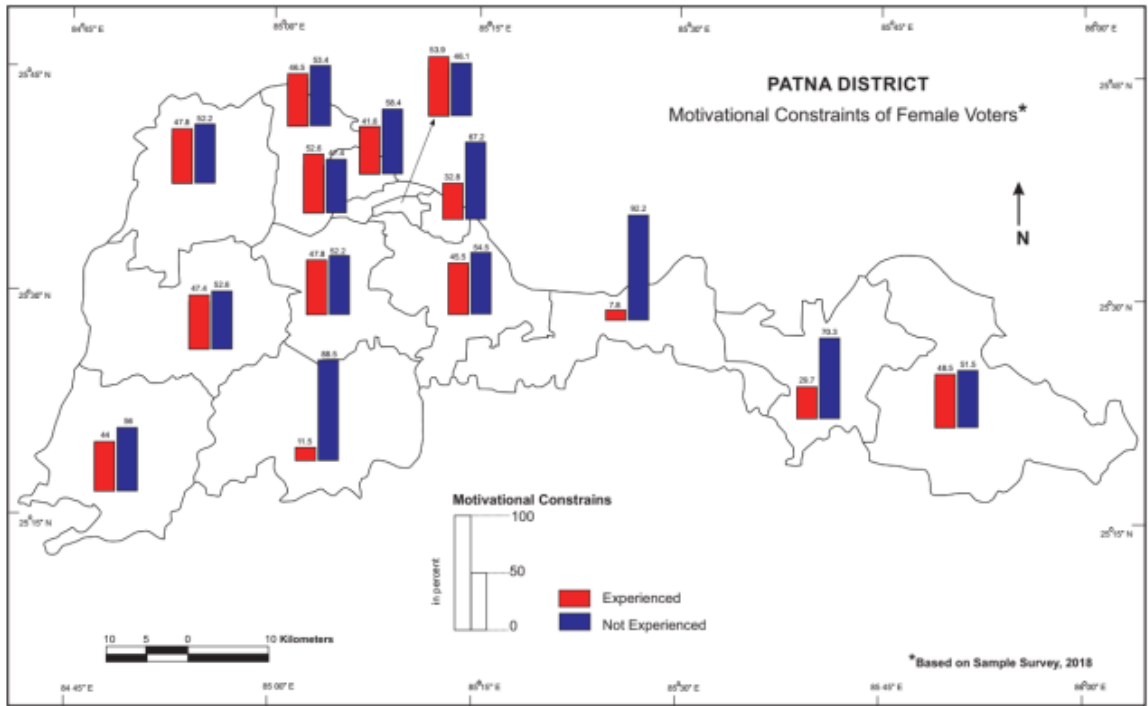


Fig.2

Figure 2 show that 20 percent of women from rural area, 37.3 percent from semi-urban and 52.5 percent from urban area reported that they faced motivational constraints. 38.5 percent in Mokama, 29.7 percent in Barh, 7.8 percent in Bakhtiarpur, 33 percent in Paliganj, 37.8 percent in Bihta, 11.5 percent in Bikram and 52.9 percent of women from

Bankipur stated that they faced motivational constraints. It is reported that longer the line at polling booth, the greater the likelihood that voters will become frustrated and leave before voting. Secondly, distance from polling booth discourages voter turnout in the study area.

Situational Constraints

It is one of the factors which accounts for differences in voter participation from place to place. Among the respondent 38.6 percent (379/986) were responded as they face situational constraints such as distance of home from polling booth, long queue, domestic responsibilities, and poor health condition during elections, and not living in the home town etc.

This is a phenomenon in India where section of the society are intimidated and terrorized before the polling days usually prevent them to vote (Narain1969). Sometimes sporadic violence on the polling day prevents the people to vote. 51.3 percent females did not face any situational constraints during election (Table 2). According to figure 3, 55

percent from urban area, 53.9 percent from semi-urban area and 32.5 percent in rural area faced situational constrains. 55.8 percent from Mokama, 23 percent from Bakhtiarpur, 56.3 percent from Maner and 37.3 percent from Digha faced situational constrains during voting.

Table-3: Situational Constraints among Female Voters of Patna District

Situational Constraints	Urban	Semi-Urban	Rural	Total
No Constraints	113 (33.5%)	97 (35.1%)	296 (57.5%)	507 (51.3%)
Constraints	132 (55.5%)	118 (53.9%)	219 (32.5%)	379 (38.6%)

Source: Sample Survey, 2018

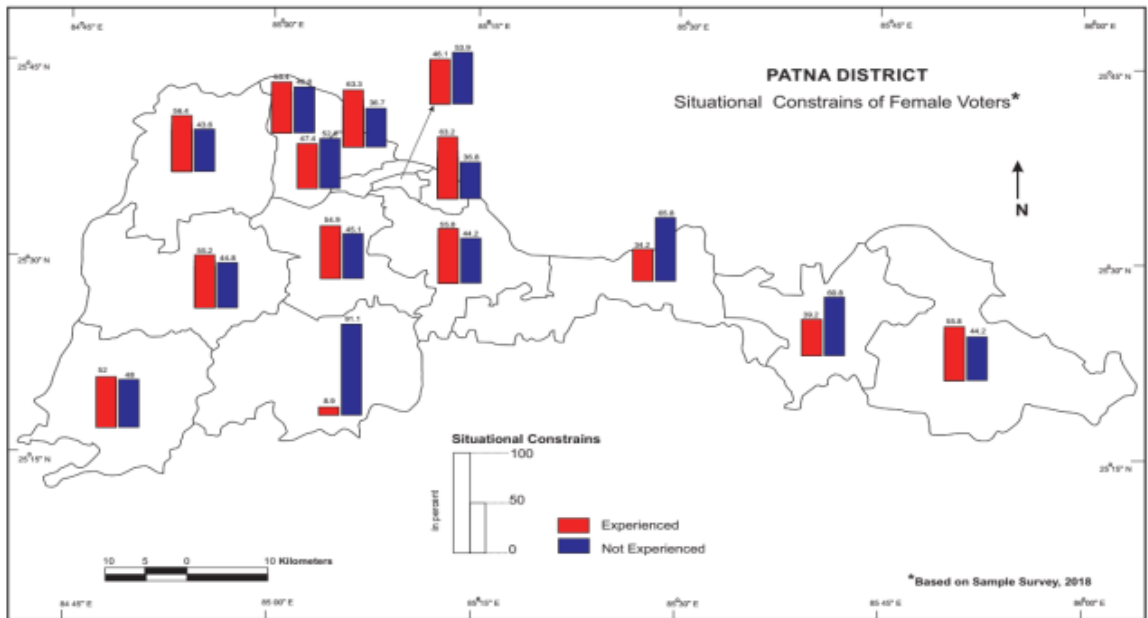


Fig. 3

Conclusion

The above discussion summarizes that urban women vote less than their rural counterparts. There is significant association among place of residence and

choice of a particular party to vote. A statistically significant cumulative trend is observed towards BJP, while a declining trend is observed towards

INC in comparison of assembly election held in 2005 February to 2015 assembly election.

The value of democratic choice critically depends on voter's motivation. If voters are motivated, voting may result in smart choices because of information aggregation. Motivational constraints comprise lack of education, not liking the candidates; no faith on political parties, dissatisfaction from the government and political apathy etc. are some of the common situational constraints.

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Remote Sensing of Environmental Change in Joda and Barbil Sector, Odisha due to Mining and Mineral Processing

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Abstract

Mining regions are more prone to environmental pollutions for which monitoring landuse/land cover and management of vegetation cover are critical in prioritizing planning regions. There are several studies on land use and land cover (LULC) for the sustainable management of environment. Studies suggested mining and related activities has dynamically changed the landscape scenario (Arendran et al. 2013; Joshi et al. 2009; Malaviya et al. 2010) in many areas resulted in decreased vegetation cover (Yamamura et al. 2009; de Koning et al. 2007), increased pollution (Abdulkareem et al. 2018; Chen et al. 2009; Xiao and Ji 2007) soil degradation (Islam and Weil 2000; Tolba et al. 1992) and growth of urban spaces (Wu and Zhang 2012; Rahman et al. 2011; Yuan 2010; Batta et al. 2010 and Batta 2009). With the advancement of remote sensing technology coupled with geographical information system (GIS) there are several developments in modelling spatial and temporal land use and land cover. Open availability of free satellite images (Landsat, Resourcesat, ALOS Pulsar, Ikonos etc) has widened the field of study.

1. Aims and Objectives of the Study:

- To study the spatio-temporal land use land cover pattern and its changes.

- To optimize the future land use pattern in light of upcoming mining activities in the study area and its associated impacts.
- To prioritise the study area on the basis of land use land cover change, NDVI and NDBI for mining environmental degradation.

2. Study Area

The study area extends from Latitude: 21°52.5'0" to 22°7'3" N and Longitude: 85°20'0" to 85°30'0" E falling in toposheet number **73 F/8**. The Joda-Barbil area is located in Joda block in the northern part of Keonjhar district of Odisha. It hosts some of the richest iron ore deposits in India that has seen unprecedented industrialization. Although this enriched the economic life of people living in Joda-Barbil area, it has also caused the living conditions to deteriorate steadily. This has degraded the land, soil, water, and atmosphere intensely and fastened the rate of weathering, erosion resulting in reduction of forest cover. It has affected flora and fauna of the towns and also have the rivers and streams polluted by the effluents released from these processing plants (Schmidt et al., 1998). The atmosphere of Joda and Barbil are laden with dust due to mining activities. The problems of waste rock dumps become devastation to the landscape around the mining areas.

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3. Geological setting

The study area is a part of Pre-Cambrian Banded Iron Ore Formation (BIF) belt comprising the Keonjhar Iron Ore province of Eastern Indian shield of Odisha. The important rock types of the area are banded hematite jasper (BHJ), shale, mineralised manganese phyllites, dolerites, limestone, massive iron ore, basic lavas and Kolhan conglomerates (SGAT, 2006). The various flow systems originating from the study area and its catchments constitute well developed perennial and ephemeral rivers, tributaries, streams, springs, monsoon rivulets and drainages of diverse patterns. The

Baitarani river constitutes the main perennial river flowing from south to south-east over conglomerate in the southern catchments of the study area. The Karoriver originating from the altitude of 570m and draining the entire northern sector of the study area, flows over shales and phyllites having its trends from south-west to north direction. The area has been cut by several nalas which originating from the river Karo running from NW to South. The entire flow systems in the study area are controlled by minor local cracks, joints, rock fractures, and major tectonic lineaments.

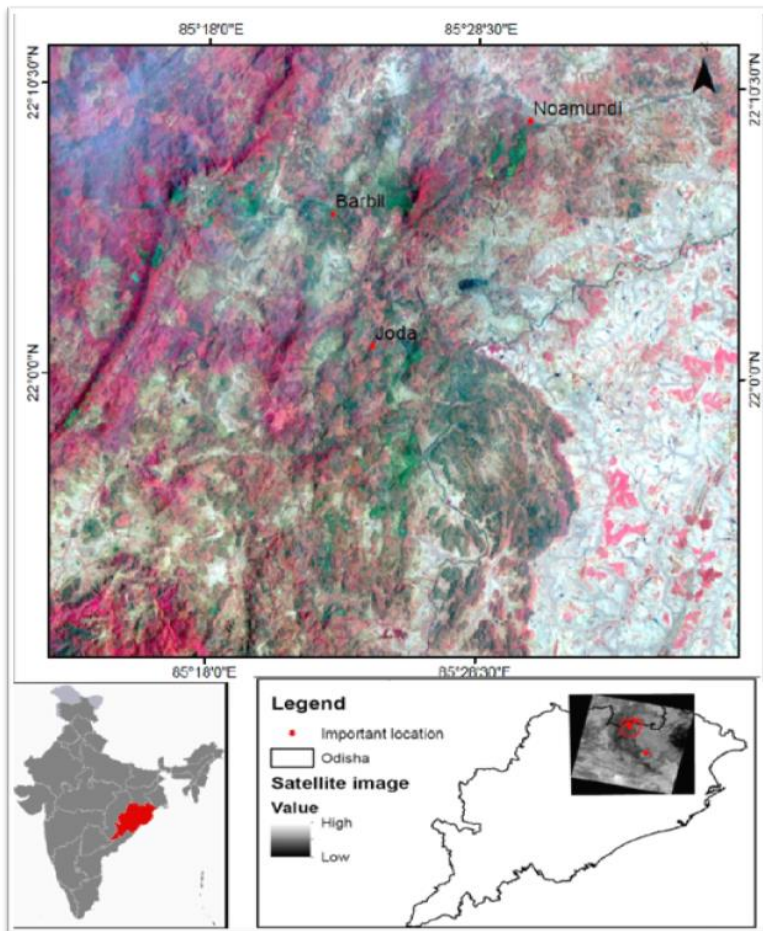


Fig.1: This map shows the study area which is in Keonjhar district of Odisha; Here red dots are the important locations within the study area

4. Methodology

4.1 Data collection

The topographical map 73 F/8 was collected from Survey of India for the demarcation of study area moreover satellite data (Landsat TM,ETM+ and OLI) of Joda and Barbil regions were downloaded from USGS Earth explorer (<https://earthexplorer.usgs.gov/>) for the calculation of NDVI, NDBI and LULC This study ranges from 1996-2019 for the temporal analysis, hence we have taken satellite image of years 1996, 2011 and 2019 respectively. All the data are processed using ArcGIS and ENVI softwares.

4.2 NDVI calculation

The Normalized Difference Vegetation Index is a numerical indicator that uses the visible and near infrared(NIR) bands of the electromagnetic spectrum, and is adopted to analyze remote sensing measurements and to know whether the target being observed contains live green vegetation or not.

As shown below, Normalized Difference Vegetation Index (NDVI) uses the NIR and red channels in its formula.

$$NDVI = \frac{NIR-RED}{NIR+RED} \dots \dots \dots \text{equ}(1)$$

4.3 NDBI calculation

The normalized difference built up index has been useful for mapping urban built up areas and mining regions, using Landsat products This is calculate by equ (2).

$$NDBI = \frac{NIR-SWIR}{NIR+SWIR} \dots \dots \dots \text{equ}(2)$$

4.4 LULC calculation

Land use/land cover (LULC) changes play a major role in the study of global change. Land use/land cover and human/natural modifications have largely resulted in deforestation, biodiversity loss, global warming and increase of natural disaster-flooding.

These environmental problems are often related to LULC changes. Therefore, available data on LULC changes can provide critical input to decision-making of environmental management and planning the future.

Here we have used minimum distance to mean method of classification for the land use and land cover mapping. For the 3 years data, we have used a standard class of 5 for each year for the thematic map creation.

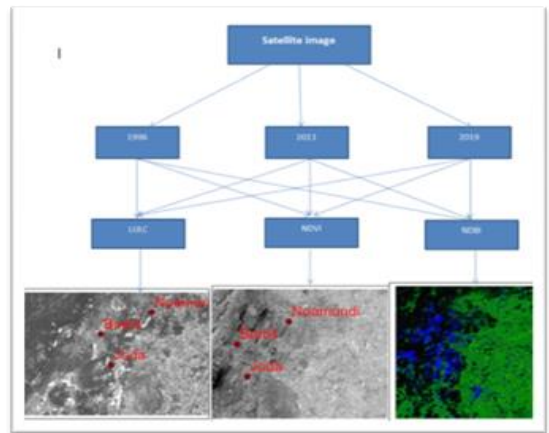


Fig.2: Flow chart shows the methodology of this study

Result and discussion

a. NDBI

This result shows that built up index increased with time and the change from 1996 to 2011 is more than the 2011 to 2019. The result also showed that mining regions are increasing at a slower rate than previously. A total of 720km² area is covered by mining region in the year 2019. In the fig.4, the mining region is shown in red color which is very less compared to others.

NDBI is calculated from the near infra red and green band of the Landsat image. It is the ratio between the difference and sum of green and NIR bands.

Here all the lower values are the vegetated zone. From the time series data it is cleared that vegetated zones are increasing with time. That increase may be due to some error in our calculation or artificial plantation by mining companies. Red shows the presence of mining areas in figure 4 where as yellows shows the othe mixed features.

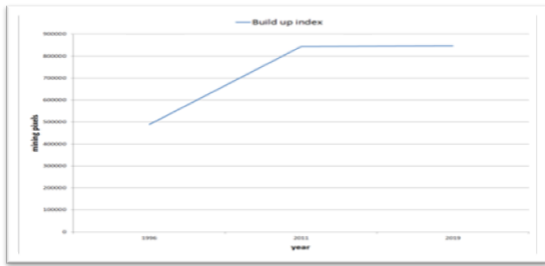


Fig.3: This graph shows the change in mining regions in the studied region during our studied Period

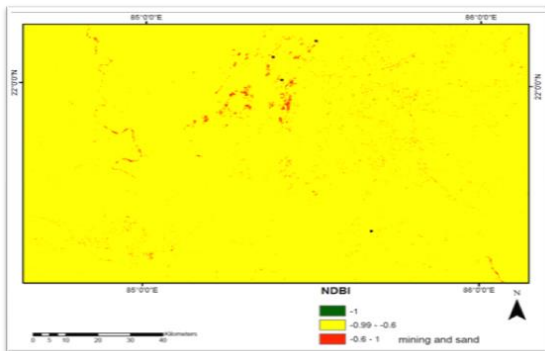


Fig.4: This figure shows the NDBI of the study area whereas red colour shows the building or mining regions and along the river channel red also seen which is actually sand

NDVI is calculated from the near infra red and green band of the Landsat image. It is the ratio between the difference and sum of green and NIR bands. Here all the lower values are the vegetated zone. From the time series data it is cleared that vegetated zones are increasing with time. That increase may be due to some error in our calculation

or artificial plantation by mining companies. Figure 5 is showing the NDBI for the year 1996.

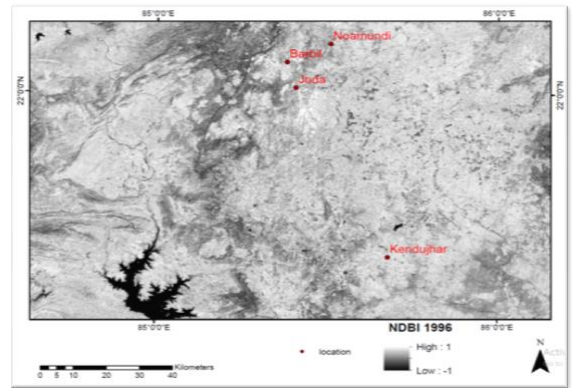


Fig.5: This figure shows the NDBI in grey scale of the studied region for the year 1996; here -1 is the lowest value and 1 is the higher value

NDBI is calculated from the near infra red and green band of the Landsat image. It is the ratio between the difference and sum of green and NIR bands. Here all the higher values are the vegetated zone which is white in color. From the time series data it is cleared that vegetated zones are increasing with time. That increase may be due to some error in our calculation or artificial plantation by mining companies.

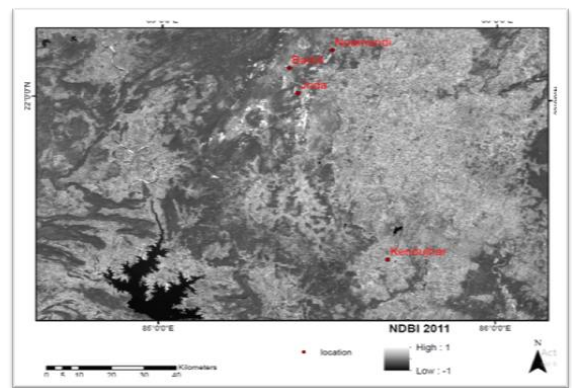


Fig.6: This figure shows the NDBI in grey scale of the studied region for the year 2011 ; here -1 is the lowest value and 1 is the highest value

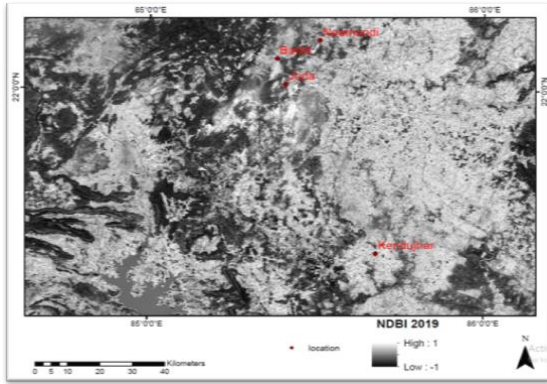


Fig.7: This figure shows the NDBI in grey scale of the studied region for 2019; ; here -1 is the lowest value and 1 is the higher value

LULC calculation

Land use land cover map is created for the study region in ENVI (version 5.3) software. We have classified this region into five classes i.e., densely vegetation, agriculture field, waater, mining and buildings and sands. However, we got that maximum regions are filled with aggricultural field followed by densely vegetation, water, mining and buildings and sands.

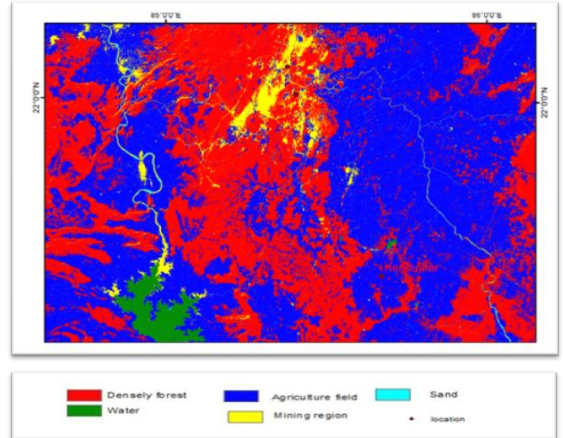


Fig.9: This figure shows the land use and land cover map of the study region for the year 2011

In this figure showing different features for the 2011; here yellow color shows the location of mining region which is in higher elevation zne verified in the google earth platform. Moreover, vegetation land is present at low land region shown in blue color. Densely forest region shown in the deep blue color. Here green color shows the presence of water.

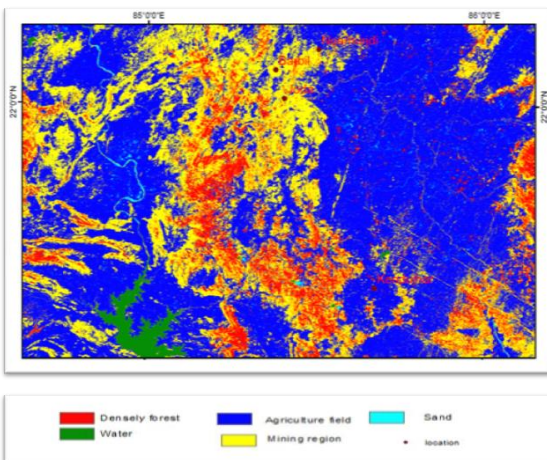


Fig.8: This figure shows the land use and land cover map of the study region for the year 1996

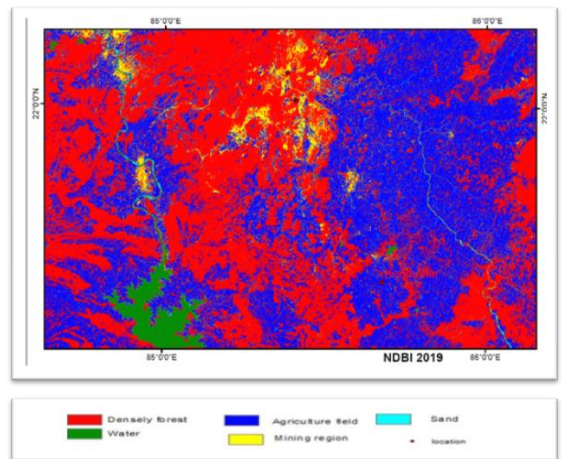


Fig.10: This figure shows the land use and land cover map of the study region for the year 2019

In this figure showing different features for the 2019; here yellow color shows the location of mining region which is in higher elevation zone verified in the google earth platform. Moreover, vegetation land is present at low land region shown in blue color. Densely forest region shown in the deep blue color.

NDVI calculation

NDVI is calculated from the near infra red and green band of the Landsat image. It is the ratio between the difference and sum of green and NIR bands. Here all the lower values are the vegetated zone. From the time series data it is cleared that vegetated zones are increasing with time. That increase may be due to some error in our calculation or artificial plantation by mining companies.

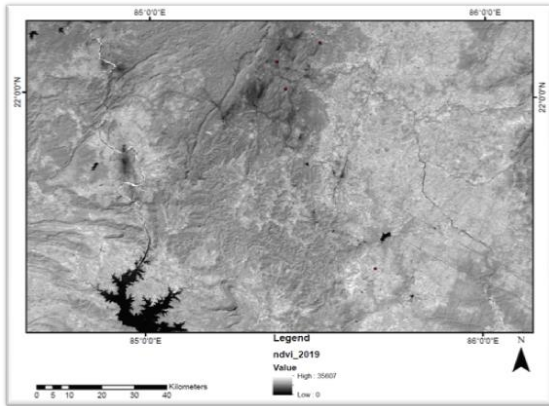


Fig.11: This figure shows the NDVI map of the study area for the year 2019

The vegetation amount in the year 2019 has reduced in compared to the 1990 which is caused by mining and construction of buildings. Deforestation has done in 2019 in a higher amount.

This figure shows that most of these region is covered by vegetation with densely shown in white pixels, whereas black color shows the presence of water.

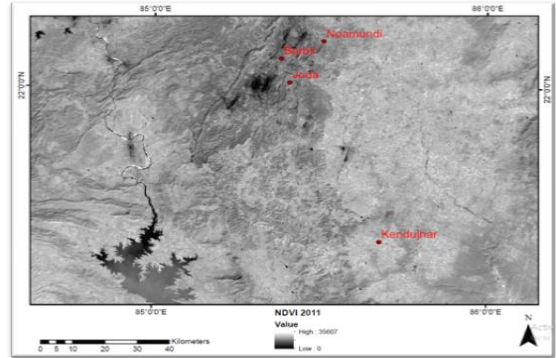


Fig.12: This figure shows the NDVI map of study area for the year 2011 Where black pixels shows the presence of vegetation

The graph in this figure showed that most of the region covered by densely vegetation followed by low vegetation sand and mining region.

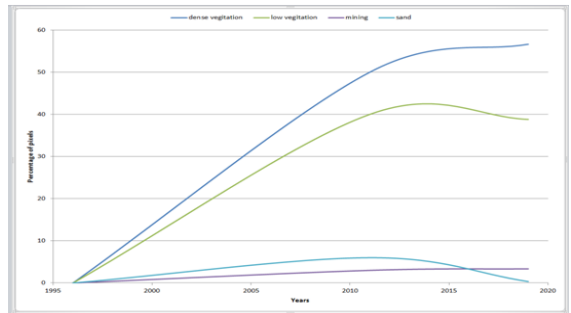


Fig.13: This graph shows year wise change in land use and land cover in the study region

Mineral mapping in the intensive study area

Mineral mapping has been done in the intensive part of the study area. For doing this we have used band ratio techniques. The ratio between SWIR and NIR band gives the presence of sentire iron oxide related mineral in the study area. In figure gives the idea about the iron mineral present in the study area. Here red color shows the iron oxide mineral where as the blue color shows the vegetation zones. A Google earth image is given in the figure for comparison purpose which is fully matched in our result.

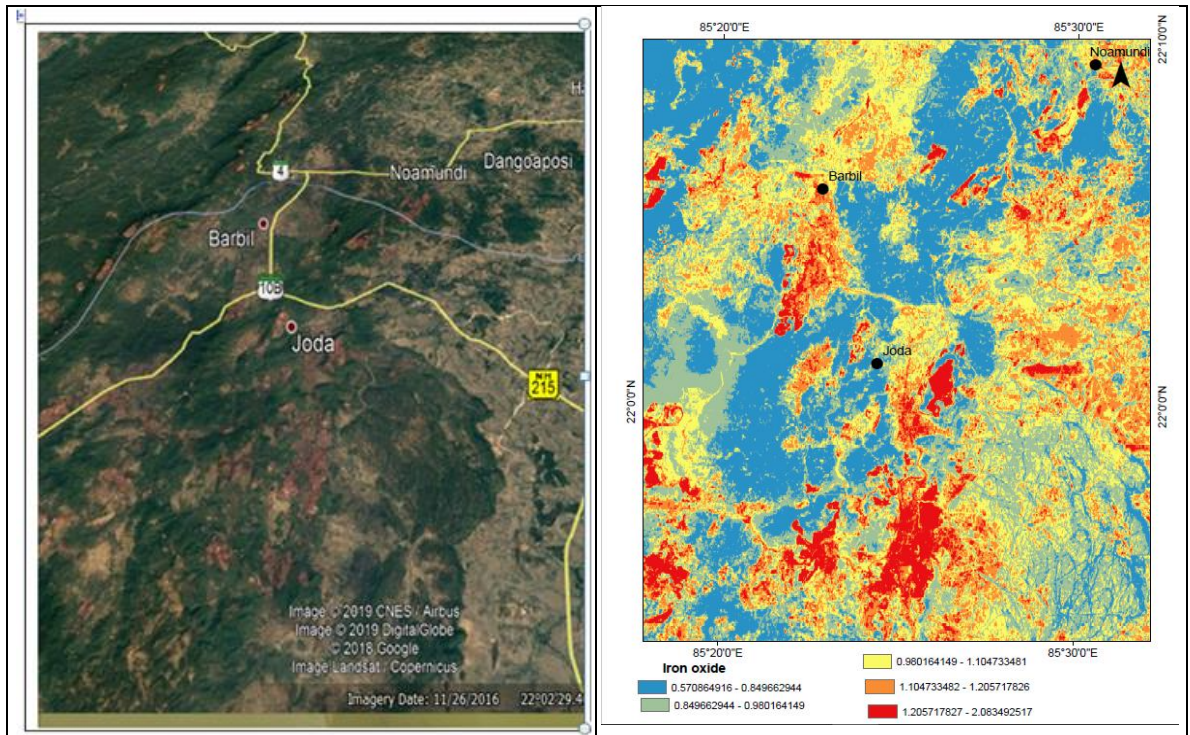


Fig.14: This figure shows the iron mineral mapping in the study area right side), whereas the left side shows the Google Earth image of the same region

Conclusion

This study concludes that mining areas are increasing with time whereas vegetation cover of the regions are decreasing. Population explosion and mining activity are the principal causes of environmental changes in this region. There will be a serious impact on environment. This study shows that the studied region is full of minerals and natural resources. With the development of mining activities there has been a growth of urban centers around the corner which even contributing to the environmental pollution such as water and air pollution in particular. The central part of the study area is to be taken care of due to the growth of urbanization the surroundings are worse off. The study shows there is change in land use and decrease in vegetation cover in the central parts infact the NDBI analysis has culminated that the built up areas

has increased over the time. Proper planning is required on organizational andbureaucratslevel to minimize the pollution and attain sustainability in environmental management.

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Organizational Interventions in Planning Bhubaneswar: Role of Development Authority and Municipal Corporation

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Dr Sasmita Rout

Abstract

Bhubaneswar City has transformed physically, socially and culturally especially after independence with the planned interventions from different agencies at different scales. Despite several attempts for planned developments Bhubaneswar is yet to be fully planned. Though reasons for such difficulties are multiple yet one of the major problems lies with lack of organizational collaboration among the concern planning agencies. Informal interactions, interviews and observations in the field with the planners, officials, residents and slum dwellers reveals several planned attempts have changed the city morphology, continuity in the planning tradition has broken and many socio-economic transformations has happened across the core and peripheries of the city. Moreover, the major driving force for such transformations are the Development Authority and the Municipal Corporation that changes the planning processes and collaborated with multiple agencies for the development of the city.

Keywords: Master plan, implementation, neighborhoods, parastatal agencies.

Introduction

“I am not crazy for metropolitan or megalopolitan cities such as Delhi, Bombay, Bangalore or Hyderabad. They are too polluted and life is almost

stagnant with heavy traffic, high cost of living and tiring days on road. After staying for a long time in Kolkata and Mumbai, often I am excited to work in a small city with almost no traffic, better quality of life and most importantly for the peace of mind that now I have”, says Dr. Archana, an Assistant Professor in Geography, Central University of Karnataka. This seems to be general feelings for many though the options for opportunities in large cities are wide and better. Here the point is cities of different orders at different scale does matter for their relevance in the regional scale and also for catering to the interests of different sections of people. Bhubaneswar (see figure 1 for the location of the city), the capital city is no exception from the people’s perspectives. Bhubaneswar, yet not being a million plus city is talk of the academic space as well as among the residents. On the other hand, Bhubaneswar is getting attention for being the capital city as well as located in the coastal belt along with a hub of neighboring cities and towns of importance. These adjacent cities/towns are known for different purposes such as Cuttack is a historically and economically rich city, Puri is a city of religious importance, Khurda, a small town of colonial importance, Jatani for commercial activities and Pipili for crafts and handlooms (known as Chandua) of international importance. Because of continuous investments on development dimensions in the capital city region many other cities or towns

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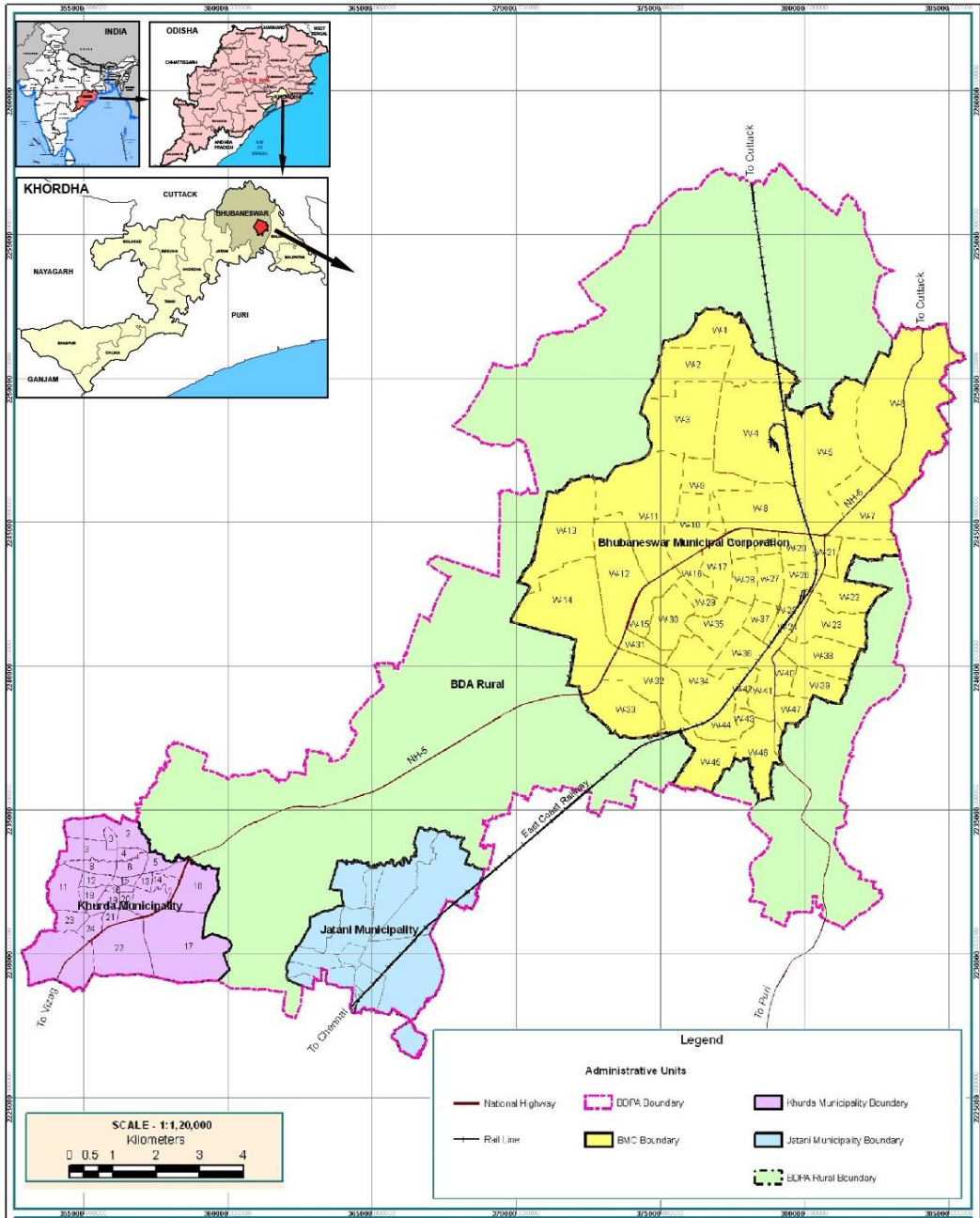


Fig. 1: Location and Area Covered under Bhubaneswar Master Plan 2010

Source: BDA, Bhubaneswar

by the Directorate of Town Planning after taking objections and suggestions from the public and SPA assists in both plan preparation and implementation at the local level

in other parts of Odisha especially in western Odisha is debated for being deprived off national and state investments. Geographers have stated that this context is creating regional disparity and widening the gaps between western and coastal Odisha. Further, discussions were also along the line of 'primate city'. But an analysis of the census data explains that Odisha is one of the least urbanized state with only 16% urban population, 9 class I city out of 223 towns/cities that spreads across the State of Odisha. Most of the urban centres are administrative headquarters of different order except a few has flourished because of industrialization such as Rourkela, Anugul, and a few are mining based towns such as Kendujhar, Joda, Barbil (iron and manganese), Talcher (coal), Gorumahishani and Badampahad (iron ore). But Odisha do not have primate city structure unlike West Bengal.

Despite a less urban population, Directorate of Town Planning along with Special Planning Authority is attempting to develop planned urban space as well as enhance urbanization in the State. For effective planning, enforcement and aesthetic development, these organizations coordinate with several other state and non-state agencies at multiple level, for example in the case of land (see figure 2). In the next sections this paper has focused on the role of Bhubaneswar Development Authority (BDA)

and Bhubaneswar Municipal Corporation (BMC) in the transformation of Bhubaneswar City with the multiple planned interventions at different period of time starting the post-independence India.

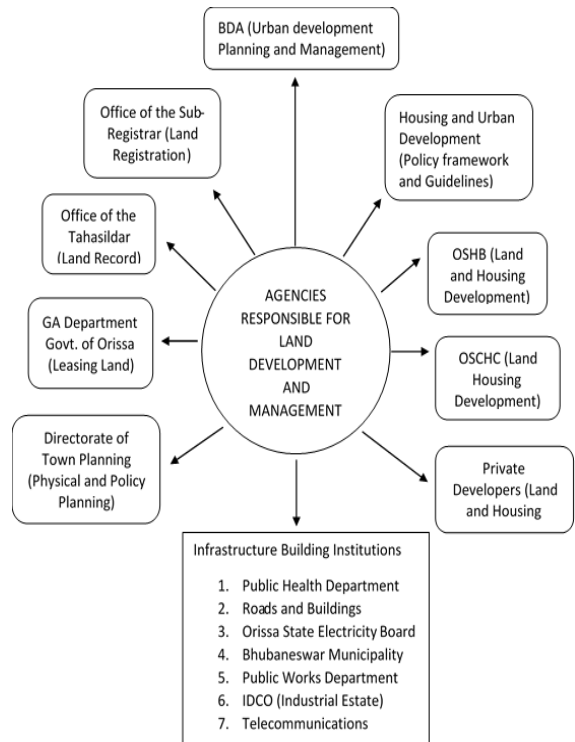


Fig. 2: Agencies responsible for land development and management

Source: Routray, 1996

¹Capital City Region includes Class I cities such as Bhubaneswar, Cuttack, and Puri and satellite towns such as Choudwar, Khurda, Jatani and Pipili. The region spreads across three districts of Odisha that comprises Puri, Cuttack, and Khurda. The idea of capital city region was highlighted by Prof S N Tripathy (former professor from Department of Geography, Utkal University) in his PhD research. Many times, people have mentioned about the development of twin city region that includes Bhubaneswar and Cuttack. Later officially in the 2010 Comprehensive Development Plan (CDP) of Bhubaneswar city, Bhubaneswar city region was mentioned as "Bhubaneswar Cuttack Urban Complex (BCUC)".

²The Law of Primate City was introduced by Jefferson in 1939 that explains a top-heavy urban structure where the hierarchical structure of the city is not only determined by the population size but also the national influence and socio-economic-political importance of the City such as Kolkata in West Bengal.

³Both Special Planning Authority (SPA) and Directorate of Town Planning are statutory bodies created under Odisha Town Planning and Improvement Trust Act 1956. Draft master plan is prepared

Bhubaneswar: Planned Interventions

Selection and Description of Field Site

Bhubaneswar is a planned city and the administrative head quarter for the state of Odisha. Bhubaneswar has remained a city with historical and religious importance. Being located in plateau region with a huge forest cover, and situated close to Bay of Bengal, climatic condition of the city was soothing, but the city has transformed physically, socially and culturally in past decades. Originally the new and planned Bhubaneswar city has developed around erstwhile villages, therefore rural characteristics are present in many neighborhoods, especially in the old city, the newly developed peri-urban area, which in due course becomes urban. The capital city was started with neighborhood planning approach and retains the rural characteristics. Bhubaneswar is also the hub for educational, healthcare and IT institutions. Spatially the city is growing to the neighboring towns such as Khurda, Jatani, Cuttack, and Pipili. Therefore, regional importance of Bhubaneswar is high and a few cities of Odisha can compete with Bhubaneswar, when Bhubaneswar itself is yet to be a million plus city.

I examine Bhubaneswar not only for its regional importance or as a planned city but also because the city is facing similar kind of problems like any other Indian cities. Spurring to know the city, the people, organizations involved and the transformations of the city in a deeper sense is also a reason for selecting Bhubaneswar as a case for the research. Moreover, seeing the scale of transformation in the city, there is still hope to make changes in the existing planning system and prepare and implement effective master plans. Making the small city a case adds further understanding on the scale and the complicity that are there because of very few researches is done comparing to huge metropolitan cities.

I was able to access files and official planning documents including master plans, minutes of

several meetings of Board of Inquiry, High Level Steering Committee, and letters that are exchanged among concerned organizations. Detail information on CDP-2010 preparation and implementation helped me in understanding the processes and functions of BDA. Information on Resident Welfare Associations and slums helped in decipher status of neighborhood organizations in Bhubaneswar and became the starting point for understanding functioning of the organizations and their role in the processes of plan implementation. Though I was able to attend monthly meeting in RWAs but in slum organization being an outsider I was strictly asked not to attend the meetings. This prevented me in getting information on functioning of their neighborhood organizations. Despite of this, ethnography of organizations helped me understanding the networking of organizations, their structure, processes and functioning in relation planning the city and its neighborhoods (Ybema et al. 2009; Ghertner 2015).

Identifying planners, officials and technical assistants involved in planning was based on their positions and involvement in planning activities. Yet, there are planners who are retired and currently in several positions such as Mr. Sudarshan Sahoo who is appointed in BMC for implementing centrally sponsored Rajiv Awas Yojana (RAY) project is my respondents through snowballing. Further, I interviewed key informants from the city such as independent planner Dr. Piyush Ranjan Rout from Local Governance Network (LGNet) and retired Secretary Mr. Nalinikanta Panda (currently part of Citizens Apex Association) from urban development department who are currently actively participating in planning activities. Their position, experience and their active engagements in the planning process in Bhubaneswar city helped me understanding the current planning practices, deviations, role of BDA and BMC, transformations in Bhubaneswar, the practical implications of

neighbourhood organizations such as Resident Welfare Associations and the slum organizations in developments of the city.

Bhubaneswar: a City with Master Plans

A city's myriad issues and problems are being addressed through master plans throughout the country with an increased fervor and belief that this modern and scientific approach is the best way forward to address actual and potential problems in cities. Today the particularities and dynamics of cities are vastly different than in the era of 1960s when Independent India began the process of formal planning to address urban problems. Our problems are, is it because, as Mathur (2012) has shown, the present planning structure is centralized and does not include local level organizations in the plan preparation and plan implementation or is it because of promoting approaches that does not fit into this master plan process, such as Mission-JNNURM, a project based approach that was started in the year 2005 and implemented in 63 Indian cities (Saxena and Vijayakumar 2014).

The relevance of a master plan is advanced in the literature in terms of growing urbanization, increasing demands for better facilities, tremendous transformation that is taking place in cities. The distribution of absolute number of master plans prepared in different states are as follows: 182 cities/towns of Rajasthan, 137 cities of Gujarat, Uttar Pradesh has 127 cities with master plans, Andhra Pradesh has 110 cities with master plans, Tamil Nadu also 123 cities with master plans, and another 50 cities are preparing master plans. The state of Odisha has 71 master plans (Directorate of Town Planning 2013). The picture revealed by the

statistics suggests applications of planning tools are not strongly correlated to increase levels of urbanization. The state of Odisha for e.g., seems to apply planning tools, either in anticipation of urbanization, or has adopted as an ideological tool by the state government.

With the growing number of master plans and the number of times master plans are prepared for a city, scholars have pointed out the relevance of master plans in the context of urban centres. More that plan preparation as a problem, ineffective implementation of master plan' in a dynamic city space with the proliferation of organizations at multiple scales and multiple levels is needs scholarly interventions. Therefore, promise of organizational intervention is recognized to help in preparing and implementing master plan effectively. In this context, this paper further discusses the history, and developments of Bhubaneswar city, planning issues, methodology and methods adopted that I explained before is to explore planned reality of the city.

Planned Interventions in the City

Bhubaneswar was one among the first planned city of independent India. Julius Lazarus Vaz, the then government architect has contributed significantly in designing the government buildings in Bhubaneswar. But, German architect and urban planner Otto Koenigsberger's emphasis on local architecture, planning the city based on climatic conditions and his stress on retaining the local characteristics, horizontal developments with not many big buildings to reduce the difference between rich and poor attracted the attention of former Prime Minister Jawaharlal Nehru who appointed

⁴ JNNURM did not represent local concerns effectively (Weinstein, Sami and Shatkin 2014; Sami 2012) Stakeholders of the JNNURM are the central agencies like MoUD, NIUA, NITI Ayog (formerly Planning Commission of India), National Institute of Public Finance and Policy, World Bank, Asian Development Bank, UNDP JNNURM is a sector specific initiative and emphasizing on housing for the poor and on mass transportation

Koenigsberger as the first town planner of Bhubaneswar city (Prahraj 2015). Koenigsberger designed Bhubaneswar based on Neighborhood Units (See figure 2). But further planning in Bhubaneswar (see table 1) did not follow the guidelines of Koenigsberger's neighborhood approach, rather followed development Authority model and presently Bhubaneswar has extended to its neighboring townships such as Khurda and Jatani (see figure 1).

Bhubaneswar is planned based on neighborhood approach. Chandigarh has also followed neighborhood planning approach based on Le-Corbusier's 'clean sweep' philosophy of planning, which explains huge buildings, identical street structures developed on an open space. Residents had lot of difficulties to adapt to a completely different environment with similar buildings and street life (Scott 1998). Koenigsberger, on the other hand, had an intention in favor of maintaining the traditional village culture diffusing with modern urban planning in Bhubaneswar. Thus Bhubaneswar differed by borrowing the ideas of mixing village and urban life instead of a completely changed setting full of tall buildings and straight roads. Multiple organizations were involved in the planning activities. Though not intentional but multiple strategies and ideas were used to plan. Like the first plan was prepared by German architect and planner Koenigsberger in 1948 (Koenigsberger 1952), second plan was prepared by Directorate of town planning, Odisha in 1968 (Town Planning Organization 1968), and third plan by Bhubaneswar Development Authority (BDA) in 1994 and the current ongoing CDP 2010 was prepared by consultant agency IIT Kharagpur with the assistance of BDA. Despite these multiple planning interventions Bhubaneswar is still unable to hold the planned characteristics. For a 'planned city', Bhubaneswar has a high proportion of slum

population (36%) is an instance to such unplanned characteristics that has developed over the years.

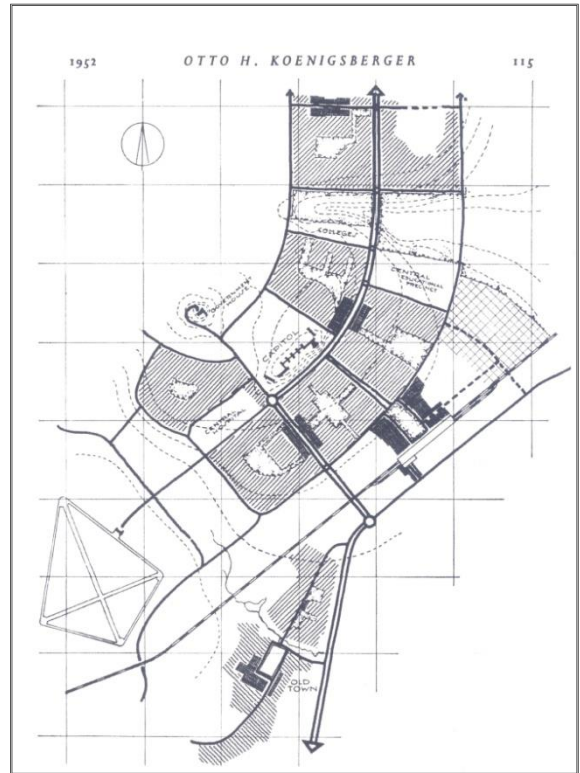


Fig. 3: Neighborhood Units of Bhubaneswar
Source: Koenigsberger, 1948

Seeing Bhubaneswar one among the lowest ranked city in India (Pradhan 2014; Pradhan 2013) these seem to be general feelings of dissatisfaction towards the city. Besides master plans, Bhubaneswar is also a JNNURM city. In 2016, Bhubaneswar secured top rank in smart city project. After a long struggle, in 2014, 74th Constitutional Amendment Act has been implemented in the city and now Bhubaneswar Municipal Corporation has a planning department. Implementation of the 74th CAA is important as it enhances the engagement of the municipal corporation in the planning process. This might reshuffle the planning activities and the

Table 1 Chronology of Planning Efforts in Bhubaneswar

- 1948: Otto H Koenigsberger prepared the First Master Plan for the Bhubaneswar City as the new capital city of Odisha.
- In 1954 directorate of town planning came in Odisha town planning act came in 1956 which basically for the improvement, development and expansion of towns.
- 1968: The GoO has created a Special Planning Authority for the Bhubaneswar City in May 1968 The Directorate of Town Planning of the GoO has prepared the second draft Master Plan for the city in July 1968.
- 1976: Bhubaneswar Regional Improvement Trust was functioned during 16-1-1976 and 191983 comprising Puri, Konark, Khurda and Jatni.
- 1977: Second Master Plan for the City was submitted to the GoO for approval.
- 1983: Bhubaneswar Development Authority was constituted under the provision of Orissa Development Authority Act, 1982 comprising of Bhubaneswar, Khurda and Jatni.
- 1983: The GoO approved the Second Master Plan and the same was treated as an interim development plan for Bhubaneswar.
- 1994: The BDA prepared the Comprehensive Development Plan (CDP) for the City and it was approved by the GoO.
- 1995: The CDP for Bhubaneswar came into operation.
- 2006: City Development Plan Report (under JNNURM) was prepared by Bhubaneswar Municipal Corporation and appraised by ASCI, Hyderabad.
- 2008: Perspective plan Bhubaneswar - Cuttack Urban Complex, Vision- 2030 was proposed by IIT Kharagpur.
- 2010: Comprehensive Development Plan for Bhubaneswar Development Plan Area, Vision 2030 is now in force.

Source: Compiled by Author from BDA website and Master plans of Bhubaneswar

role and responsibility among the Development Authority and the Municipal Corporation. Further, there are multiple organizations at multiple scale influence the planning activities of Bhubaneswar. International agencies like World Bank especially after the 29th October 1999 super cyclone, USAID in the City Development Plan (2006), JICA in 2012 in the twin city integrated sewerage project, UNDP and Asian Development Bank all made their interventions in many ways. National agencies like Ministry of Urban Development, National Institute of Urban Affairs (NIUA), or planning commission plays significant role in the decision making especially in centrally sponsored programs or projects like JNNURM. Besides, parastatal agencies like BDA, BMC, WSSB, SUDA there are many

non-state agencies like industries (Infosys, Chandrasekharpur), educational institutions (DAV school, engineering colleges) or health institutions (AIIMS, KIIMs, Ameri) have significantly influenced planning. Especially for their convenience they have developed and maintaining required infrastructure privately. Many public-private interventions have been made such as recreational space such as Nicco Park with Nicco Parks & Resorts Ltd. Despite such planning initiatives Bhubaneswar lack in plan implementation. Planners of the parastatal agencies (interviewed during June 2015) also agreed that they do not follow any structure for plan implementation. Further, for a 'planned city', Bhubaneswar is growing organically without neighborhood unit

plans and presence of similar urban problems like other Indian cities gives the reason for Bhubaneswar to become a candidate to explore the possible option for effective plan implementation.

Bhubaneswar was primarily an administrative city, which we explain through the built-up form. Expansion of the city in past seven decades is multi-fold and the city is growing in North-West and South direction by engulfing nearby townships. Uniformity in the neighborhoods of early master plan period has ruptured subsequently. 39% of the land ownership of Bhubaneswar goes to state government and government reserve lands (BDA 2010). Therefore, the state government has remained instrumental in decision making, plan preparation and implementation in the name of the people.

Chronological planned interventions (see table 1) explain the spatial expansion of the city, change in the land use, change in the city morphology, indirectly it states the increasing population of the city. Conversion of the land uses happens from forest cover and hilly land uses. Therefore a few land uses of independence time that includes old Bhubaneswar city and the newly developed neighborhoods have increased to multiple land uses in 2010. Locating industrial land uses indicates the organized and unorganized employments in the city. Expansion of the city also indicates the fragmentation of administrative units and creation of multiple organizations over the years, which has to be coordinated in the master plan preparation and implementation process.

Though Bhubaneswar is a planned city it has 30 percent of slum population. With the rapid expansion and changing land uses Bhubaneswar has to manage its growth and deal with the challenges or city planning and governance. Thus, these change in land uses communicate the challenges of master

plan to develop innovative methods or planning approach to tackle the problems and maintain spatial ordering of the city. Development Authority model allows Development Authority of the concern city to prepare, implement and take decision for any planned development. Bhubaneswar Development Authority (BDA) is the sole planning body in planning the city. In the next I discuss the role of BDA in detail.

Development Authority Model and Bhubaneswar

To understand Development Authority model and its importance in case of Odisha I have accessed information on Odisha Development Authority Act, 1982, Building Regulation, recent planning policies and programs, accessed websites of Bhubaneswar Development Authority, Bhubaneswar Municipal Corporation and Local Governance Network (LGNet), and Directorate of Town Planning. For listing master plans state wise I have accessed websites of Directorate of Town Planning and concern planning agencies of all the states and union territories of India.

In order to understand the grievances, critiques, problems, people (includes politicians) have on the functioning of BDA, I have analyzed questions asked to BDA in last 15 sessions of the Assembly that includes both 14th and 15th Assembly happened during the year 2009 to August 2015 session. In addition, analyzing BDA annual reports for the duration 1994-2013 I got information on plan preparation, plan implementation practices of BDA, co-ordination among different government and private organizations particularly consultants for housing, road, parks and other developments.

BDA being the agent of the State performs the task of plan preparation and implementation as the state is not capable of performing the task directly. But the nature of delegation of the task of preparing and implementing plans is not linear, rather functions in

iteration. With the spatial expansion of Bhubaneswar city and proliferation of organizations, and interdependency among organizations, BDA is unable to perform the task of planning the city in isolation. BDA delegates the task to outsourcing agents and functions as a boundary spanning agent. But planning activities of BDA is wide and covers multiple geographical scales with wide ranging organizations involved in planning process. Therefore, instead of functioning like boundary spanning agent, BDA needs to function as an organization that accommodate diverse views, upfront involvement of multiple organizations and institutionalize organizational design to make planning inclusive and also to achieve the task of plan preparation and implementation.

Learning from BMC

Bhubaneswar Municipal Corporation (BMC) has been playing a significant role in shaping the city and its development. For instance, initiatives taken by BMC to bring Resident Welfare Associations (RWAs) to the 'Interface with Citizens' meetings conducted every month during the service period of Aparajita Sarangi, Commissioner, BMC in 2006-07. Neighborhood organizations were called for interface meetings, rotationally to have interaction and discussion particularly on street light, sanitation, civic infrastructures, enforcement and holding tax with respective officials. Neighborhood organizations were asked to give their representation and express their problems and concerns in interface meetings. In an interaction, President of Gourinagar Vikash Parishad (RWA) explained that interface meetings were useful for their continuous interaction with BMC and they could easily approach BMC frequently for basic services and

other facilities. BMC failed to coordinate all local organizations. The idea of 'citizens interface' did not have much impact in terms of actualizing residents' demands might be either because of lack of funding or because of the number of demands were quite large that BMC was unable to accommodate, yet citizens interface was a new initiative to bring residents into decision making process. The entire process of interface meetings was not institutionalized and failed to accommodate all citizens' interests. Now occasionally BMC conducts 'interface with citizens' meetings.

BMC reflects 'Progress through Partnership' through continuous community involvement in various programs such as 'Chetana Abhijan', which was basically to make city clean and green. 'Citizen's Charter' was a document that compiled interests of BMC and RWAs and focuses on the standard service provisions and accessibility, grievances redress. BMC circulated these documents among RWAs on any new and different joint initiatives taken together.

Recently BMC has created a planning department especially with the implementation of 74th Amendment. Though BMC does not have much structural intervention in planning decisions, Mr. Patnaik, planner in BDA said, "BDA and BMC are interdependent" (Patnaik 2014). Simanta Mishra, Additional Commissioner and slum improvement officer, BMC described, "for identification and development of slums, BDA does not have much role. BDA collects information on slums from us and fits the information to specify land use that has been called as unauthorized in master plans" (Mishra 2015). BMC has conducted survey,

⁵ Boundary spanning⁵ refers to the task of linking an organization with its environment and coordinating that boundary That means boundary spanning works within institutional framework (Kristjanson et al 2009, Lehtonen and Martinsuo 2008, Aldrich and Herker 1977)

communicated to residents through concern corporators and regulated centrally sponsored City Development Plans (CDPs) for the implementation of JNNURM and RAY.

Joint ventures of BDA and BMC

In 2007, BDA and BMC had a joint venture to implement an innovative idea called vending zone. They collaborated with the vendors by regularizing street vendors in Bhubaneswar with the initiative of Commissioner, Mrs. Aparajita Sarangi. As of now BMC has 46 vending zones across 22 wards in Bhubaneswar that they have collaborated with 1699 vendors. Vending zones allowed clubbing of several small vendors or hawkers, who have been seen as street encroachers in city planning were given permanent places where they can more sell their products without the fear of being forcefully evacuated at any time. The idea was to recognize the informal vendors with trade license to sell vegetables and other goods in partnership with BMC. BMC did the survey and National Association of Street Vendor India (NASVI) along with BMC fixed kiosks in legally sanctioned vending zones.

Both the vendors' organization and city authorities such as BMC and General Administration (GA) Department collectively came up with this solution in December 2006 after multiple rounds of brainstorming and social dialogues. Other stakeholders participated in the creation of vending zones were BDA, Public Works Department, National Highway Authority of India, Orissa Industrial Infrastructure Development Corporation, Forest Department, Local Police and Regional Transport Office together called as City Management Group (CMG) (Kumar 2012). Vending zone is public-private-community partnership

model. Selecting the site, continual communication and frequent interactions between the vendors and vendors association, public agencies, NGO called Bhagidari and private agencies including advertising companies, local bodies such as Rotary clubs or Lions clubs. NASVI collects annual fees from the vendors and deposit it to BMC.

Interventions in the forms of vending zone partly address as the issues of urban poverty and making the city clean and better. Though not directly related to city planning, yet this collaborative model shows how different stakeholders worked together for the advancement of mutual interests. The model is beyond coordination rather is based on collaboration, translation of ideas, and interests of the vendors through the vendors association. In many ways this initiative comes close to the understanding of the promises of an organization that identify the issues or problems and addresses multiple issues at multiple scales.

Continuous involvement of BMC with the residents is also reflected in the successful implementation of vending zone in Bhubaneswar. BMC regularized street vending in the year 2007. Till today BMC has opened 46 vending zones and enrolled 1699 vendors that also include women vendors. Vending zone model is participatory and inclusive, allows organizations representing informal sectors to participate in the decision making process. This intervention of BMC has the potential in addressing urban poverty by creating a secure and conducive environment for the vendors.

Several such instances can be brought in to explain how Bhubaneswar has changed with the interventions made by several parastatal and state agencies such as BMC. BMC also opened many

⁶ Detail information on vending zone is in chapter 4

opportunities for the residents, especially the poor, marginalized and informal sector people to participate in decision making process. In many respects therefore, BDA, the sole plan preparing body must learn the collaborative approach that BMC has initiated by involving residents and the multiple agencies at multiple scales and level. Beyond master plans, there are number of plans that exist in Bhubaneswar such as City Development Plan under JNNURM, Service Level Improvement Plans (SLIPs), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart City Mission.

Conclusion

We have already seen that one way to respond meaningfully and efficiently to complexities and dynamics in cities, there is a need for a porous, flexible, and accommodative organizational structure of governance. Structure of organizations is crucial for better urban governance, and an appropriate organizational structure has the potential to change outcomes (Nallathiga 2008). An organizational structure will either facilitate or constraint interface among social, economic, and political agencies at various levels. Universities for e.g. could be seen as unique organizations with distinct structures and missions. Therefore, whether formal or informal all organizations basically follow some form of structures. Internal organizational structure and structure of network of organizations concerns variations in the cohesiveness of the region (Schoonhoven and Dobbin 2010). Therefore, understanding organizational structure of BDA that actualizes the intent of planning in Bhubaneswar becomes relevant.

The vending zone concept is based on collaboration among multiple organizations that includes NGOs, parastatal and non-state agencies. Vending zones also brought informal sector into account, gave a way out for the poor and marginalized. Hawkers are

ubiquitous in the city and provide valuable services to citizens. Yet, it could cover less than half of the wards of total wards. This may very well true to be inclusive while handling this single issue of rehabilitating vendors in the identified zones, yet the model sits with the zonal scale of the Development Authority model. Thus zoning, in the development authority model, is undermining neighborhood planning envisaged for Bhubaneswar city. Therefore, bridging the gap between development authority and other parastatal agencies with the neighbourhood organizations is relevant for an inclusive and planned developments.

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Rural Services Development and Accessibility: A Micro Level Study in a Panchayat Area of West Bengal in India



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Abstract

Quality of rural livelihood is depends on the availability of existing rural services in the Panchayat area Rural services are considered roads, electricity, drinking water, primary education, health, cooperative and Gramin bank, play ground and market. Accessibility of these mandatory rural services is not so well in every villages of rural West Bengal. The main objectives of this work are to highlight the condition of rural services, to measure the accessibility and spatial variation in rural services development in the Panchayat area. We have considered two hundred and sixty samples through random sampling method from thirteen villages People's perceptions have been considered for come to the decisions. Mean and standard deviation methods have been applied to highlight the inter village variation in rural services development. We have calculated Total Average Distance (TAD), nested mean, combined mean to reveals the spatial variation of accessibility in rural services. Inter villages disparities exist in the area in development of mandatory rural services, and scenario of many villages are in poor condition This work may be implemented to measures the disparities in village services development in any rural areas of India and suitable for reducing disparities in rural development in future.

Keywords: Rural, services, spatial variation, development, accessibility.

Introduction

Minimum level of rural services is essential to prevailed daily life in village areas. Road, drinking water, electricity, pre-primary and primary education, health, play ground, cooperative and gram in bank come under the rural services. Scenario of rural services development is varies in Kumarara Gram Panchayat of Nandakumar block, Purba Medinipur, West Bengal Spatial variations in distribution of rural service centre and in many villages' people's cover long distance to access the mandatory rural services is very common in rural areas of the state of West Bengal. So intra-Panchayat disparities in rural services development are common phenomena in the entire geographical area. Many villages exist in the Kumarara Gram Panchayat area where scenario of rural services development belongs in poor condition, contrary in many villages the scenario of rural services development are in good condition.

Rural areas development depends on the availability and facility of rural road, fresh drinking water, electricity supply, Primary School, health centre, etc. Inter-village and intra-Panchayat disparities in rural development are existed in the Kumarara Gram Panchayat area (Adhikary and Rath, 2018). High

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level of disparities is found in rural services ie, drinking water, primary school, Government health centre, cooperative societies, and Integrated Child Development Scheme (ICDS) centre development in Purba Medinipur district of West Bengal. In many areas people cover long distance to access the said mandatory rural services. People in Nandakumar block have to cover long distance to access the rural services (Adhikary, Rath & Das, 2019). Spatial variation in village wise distribution of rural amenities like education, medical, drinking water, agricultural credit societies, pucca village road in Purba Medinipur district of West Bengal is strongly prevails Many villages exist where scenario of rural amenities services are in rudimentary level (Adhikary, Rath & Das, 2018). Tubewell and Government primary school do not distribute according to the pressure of rural population of the villages in the Kumarara Gram Panchayat area In many villages rural service like fresh drinking water supply and primary school are in poor condition (Adhikary, 2015). Inter-village variation in rural development is found in the Bundelkhand region of Madhya Pradesh in India. Rural infrastructural indicators ie, drinking water, accessibility to road, medical facility, postal services, and market facility considered to measures the development of rural area (Sharma, 2018). Variation in socio economic development in Malda district of West Bengal is strongly prevails. Spatial variation in health, education, drinking water, electricity, gramin bank, cooperative societies, roads services is prevails in the area (Sultana and Aktar, 2016). Inter and intra Gram Panchayat imbalance growth and development exist in the Patharpratima block of South 24 Pargana district in West Bengal Regional disparity in development exist in the block, infrastructural facilities are unevenly distributed (Adhikary and Chakraborty, 2012). Block-wise spatial variation of Village Panchayat performance in rural development exist in Purba Medinipur district of West Bengal. Intra district disparity in

rural development is common phenomena in the Purba Medinipur district area (Adhikary and Rath, 2019).

Study area

Kumarara Gram Panchayat is come under the Nandakumar community development block of Purba Medinipur district in West Bengal, India. The said Gram Panchayat consist of 13 villages ie, Bagmari, Mandergechia, Haripur, Kumarara, Dhitaibasan, Naikundi, Jashnan, Rautouri, Namal, Fatehpur, Jamburbasan, Khajurberia, Mahammadpur. Total population of these 13 villages is 27834 (Census of India, Purba Medinipur: 2011). In the said Panchayat area 15% population is belongs in the minority community. Total male and female population in the geographical area is 14358 and 13476 (Census of India, Purba Medinipur: 2011). Total number of household in the Panchayat area is 6330 The study area is familiar for the low literacy region, male literacy 54.40% and female literacy 45.58%. The area is formed by the alluvial deposition of river Haldi and favourable for agriculture practice, mainly paddy cultivation. Monsoonal rainfall and dry winter is the common climatic character in the area.

Objectives

The objectives of this work are as follows-

- 1 To highlight the condition of rural services in the area.
- 2 To find out the spatial variation in rural services development in the Panchayat area.
- 3 To measure the accessibility of rural services in the area.

Data base and methodology

District census handbook, Purba Medinipur (2011); office of the Gram Panchayat, Kumarara is the sources of secondary data. Primary survey is the source of primary data. We have considered random sampling method for respondent's selection from

the entire geographical area and total sample size is 260. The entire study depends on the people's perceptions. We have considered 8 parameters and 15 variables in the entire work. These are briefly reveals in the Table 1. Assign ranking of all variables and rank has been arranged in ascending or descending on the basis of nature of data. We have calculated total rank of each village, mean, standard deviation of total rank, and categorized the villages on the basis of mean and standard deviation method. People's travel average distance to access the

drinking water source, primary school, Integrated Child Development Scheme (ICDS) Centre, Government health centre, play ground, Cooperative and gramin bank, and rural market have been considered to highlight the village wise accessibility of rural services. We have calculated mean, combined mean (Singh and Yadav, 1982), nested mean (Adhikary and Chakraborty, 2012), Total Average Distance (TAD), correlation coefficient of Pearson's for highlight the spatial variation of accessibility in rural services.

Table-1: Parameters and variables considered in the work

Parameter	Variables
1 Road	Availability of concrete road (x _i), Availability of good condition road during rainy season (x _{ii}), Moderate category road width (x _{iii})
2 Drinking water	Percentage of household access fresh drinking water (x _{iv}), Seasonal crisis of drinking water (x _v), Absence of drinking water in Tubewell in summer (x _{vi}), Volatile water is come from Tubewell in rainy season (x _{vii}), People's travel average distance to access the drinking water source (x _{viii})
3 Electricity	Moderate quality of power supply (x _{ix})
4 Pre-primary and primary education	People's travel average distance to access primary school (x _x), People's travel average distance to access the Integrated Child Development Scheme Centre (x _{xi})
5 Health	People's travel average distance to access the Government health centre (x _{xii})
6 Play ground	People's travel average distance to access play ground (x _{xiii})
7 Cooperative and gramin bank	People's travel average distance to access cooperative and gramin bank (x _{xiv})
8 Rural market	People's travel average distance to access rural market (x _{xv})

Source: Prepared by authors from literature survey

x_i, x_{ii}, x_{iii}, x_{iv}, x_v, x_{vi}, x_{vii}, x_{ix} Variables considered in percentage

x_{viii}, x_x, x_{xi}, x_{xii}, x_{xiii}, x_{xiv}, x_{xv} Variables considered in Km

$$TAD = AD_{x_{viii}} + AD_{x_x} + AD_{x_{xi}} + AD_{x_{xii}} + AD_{x_{xiii}} + AD_{x_{xiv}} + AD_{x_{xv}}$$

Where, AD = Average distance in Km travel by the local people's to access the particular services; x_{viii}, x_x, x_{xi}, x_{xii}, x_{xiii}, x_{xiv}, x_{xv} = Indicate variables; TAD= Total Average Distance in Km

$$\text{Correlation coefficient, } r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{n})(\sum Y^2 - \frac{(\sum Y)^2}{n})}}$$

Where, X= Independent variables, Y= Dependent variables, n= Number of data-pair

Combined mean, \bar{X}

$$= \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2 + \dots + N_n \bar{X}_n}{N_1 + N_2 + \dots + N_n}$$

Where, N₁, N₂ = Number of data in variables;

\bar{X}_1, \bar{X}_2 = Mean of variables

$$\text{Standard Deviation, } \sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{N}}$$

Result and discussion:

Demographically the study area is fall in the high population density region in state of West Bengal. Mahammadpur, Rautouri, Namal, Khajurberia and Haripur village is come under the high population density region in the Kumarara Gram Panchayat. Highest and lowest population density is found in

Namal and Fatehpur village. Geographical area is highest in Kumarara and lowest in Rautouri village. Total number of household in the entire geographical area is 6330. Household density is maximum in Rautouri and minimum in Fatehpur village.

Table-2: Demographic character of villages

Village name	Area in sq Km	Total population	Population density (/ sq Km)	Number of household	Household density (/ sqKm)
Bagmari	04935	1096	222087	268	54306
Mandergechia	12799	2691	210251	651	50863
Haripur	06159	1773	287871	400	64946
Kumarara	19138	4231	221074	930	48594
Dhitaibasan	09754	1615	165573	348	35678
Mahammadpur	18227	4614	253141	1090	59801
Naikundi	09668	2540	262722	574	59888
Jashnan	07004	977	139492	219	31268
Rautouri	02981	870	291848	201	67427
Namal	07841	2298	293075	483	61599
Fatehpur	12090	1643	135897	388	31679
Jamburbasan	11290	1751	155093	374	33127
Khajurberia	06069	1735	285879	404	66568

Source: Census of India, 2011 and computed by authors

Rural road is known as lifeline of rural development. In modern time rural areas of West Bengal is familiar with cemented or concrete road, but in Kumarara Gram Panchayat area of Nandakumar block, many villages have been exist where distribution of good quality road for all seasons are in poor condition. Concrete road is almost absent in the Dhitaibasan village. Not found single black topped road in the entire Panchayat area. Morum road is dominant in Dhitaibasan village. A big percentage of village area ie, 30% is also come under muddy road and the villages are Mandergechia, Dhitaibasan, Naikundi, Namal and Khajurberia. Concrete road is the main category of road in the Bagmari, Mandergechia, Haripur, Kumarara, Mahammadpur, Naikundi, Rautouri, Namal, Fatehpur, and Jamburbasan village. Water

logging is one of the major problems in many villages ie, Dhitaibasan, Naikundi, Namal, and Khajurberia in rainy season. Road is narrow in the area except Fatehpur village, and road width in the entire Gram Panchayat area is moderate in nature. Tubewell is the main source of drinking water in the entire geographical area. But the distribution of Tubewell in the geographical area does not match with the population distribution. Consequently in many villages of the area people's have to travel long distance to access the fresh drinking water source. Problem of drinking water in summer and rainy seasons is very common in the area. Absence of water in Tubewell and low flow of water from Tubewell is common problems in summer. Bad smell, volatile water, high iron in the drinking water is very common in the entire geographical area.

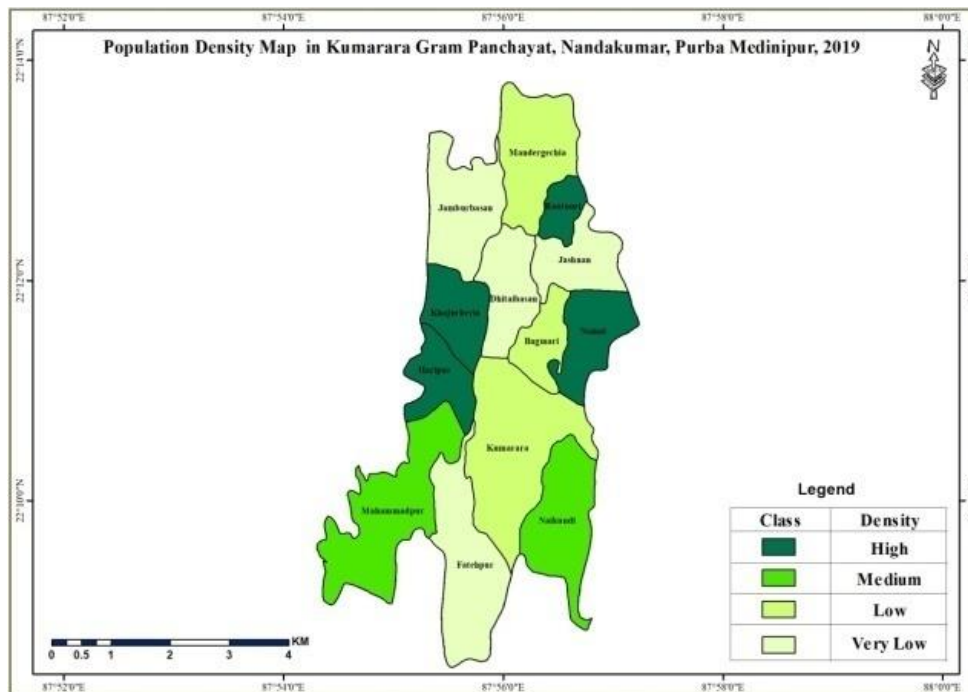


Fig.1: Population density map

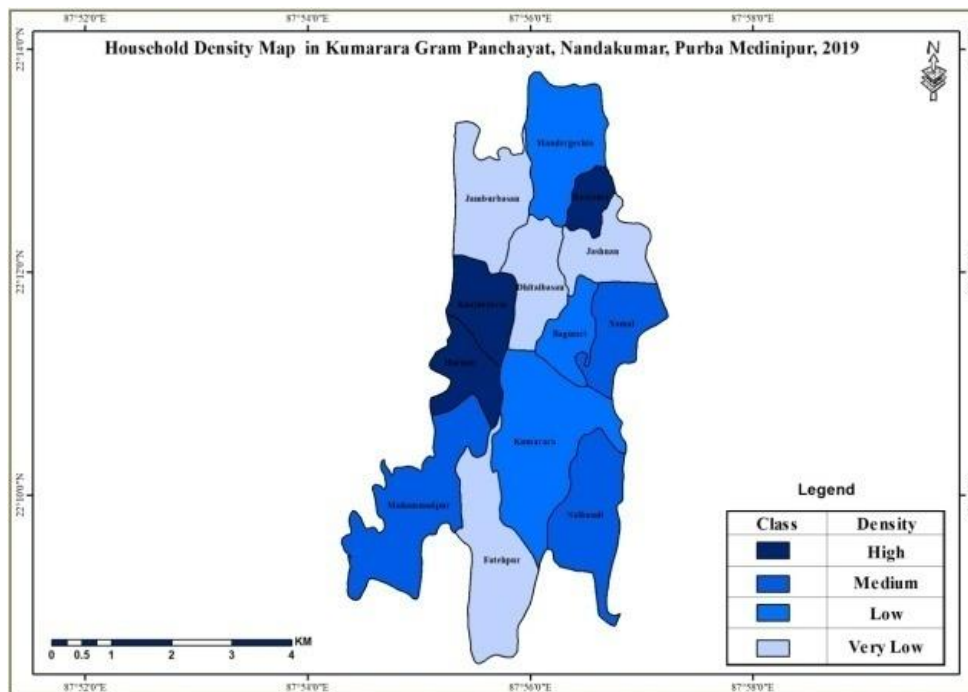


Fig.2: Household density map

Table-3: Database of variables

No	X _i	X _{ii}	X _{iii}	X _{iv}	X _v	X _{vi}	X _{vii}	X _{viii}	X _{ix}	X _x	X _{xi}	X _{xii}	X _{xiii}	X _{xiv}	X _{xv}
1	7392	6087	1783	8696	3696	1304	1304	0061	5625	013	013	15	143	112	186
2	4444	4444	2222	4444	8889	4444	4444	096	8889	102	144	239	233	267	272
3	60	60	6334	50	90	333	3667	069	8669	035	035	108	12	13	12
4	7222	6944	5833	7508	75	25	1667	0063	8333	1147	059	153	150	039	158
5	00	00	5455	5909	3182	455	455	015	7273	078	078	155	178	229	198
6	50	364	5919	100	9545	682	45	017	100	202	20	19	045	15	14
7	6875	375	6875	50	875	625	25	0360	875	048	048	195	169	211	065
8	2727	2727	5454	7227	9090	3636	3636	004	9090	057	057	097	054	30	054
9	50	50	30	60	100	40	50	015	70	106	112	222	150	240	254
10	625	5625	375	9375	4375	625	625	006	8125	030	025	163	125	147	116
11	60	6667	40	4667	5333	667	00	0015	80	0874	0408	103	123	176	32
12	7272	7272	7272	8181	7272	3637	2727	009	9090	092	086	147	110	209	223
13	1875	25	4375	875	375	00	00	00047	5625	048	021	123	180	135	084

1, 2, ... 13 Reveals the village number: Source: Computed from primary survey, October-2019

1 Bagmari 2 Mandergechia 3 Haripur 4 Kumarara 5 Dhitaibasan 6 Mahammadpur 7 Naikundi 8 Jashnan 9 Rautouri 10 Namal 11 Fatehpur 12 Jamburbasan 13 Khajurberia

Table-4: Rank order of variables

No	X _i	X _{ii}	X _{iii}	X _{iv}	X _v	X _{vi}	X _{vii}	X _{viii}	X _{ix}	X _x	X _{xi}	X _{xii}	X _{xiii}	X _{xiv}	X _{xv}	Total Rank
1	1	4	13	4	2	7	6	5	12	1	1	6	7	2	7	78
2	10	8	2	13	9	12	12	13	4	10	12	13	13	12	12	155
3	65	5	7	105	10	2	11	7	6	3	4	3	4	3	5	87
4	3	2	9	6	7	8	7	6	7	12	7	7	85	1	6	9650
5	13	13	4	9	1	3	4	95	10	6	8	8	11	10	9	11850
6	85	10	3	1	12	13	3	11	1	13	13	10	1	6	8	11350
7	4	9	6	15	8	45	8	12	5	4	5	11	10	9	2	9900
8	11	11	1	7	11	9	10	3	25	5	6	1	2	13	1	9350
9	85	7	12	2	13	11	13	95	11	11	11	12	85	11	11	15150
10	5	6	11	8	4	45	5	4	8	2	3	9	6	5	4	8450
11	65	3	10	12	5	6	15	2	9	7	10	2	5	7	13	99
12	2	1	5	5	6	10	9	8	25	8	9	5	3	8	10	9150
13	12	12	8	3	3	1	15	1	13	9	2	4	12	4	3	8850

Source: Prepared from table 3

X_i, X_{ii}, X_{iii}, X_{iv}, X_{ix} Variables ranking in descending order

X_v, X_{vi}, X_{vii}, X_{viii}, X_x, X_{xi}, X_{xii}, X_{xiii}, X_{xiv}, X_{xv} Variables ranking in ascending order

In modern time rate of rural development are depends on the per head rate of power consumption. But in the study area quality of power supply is not well in every season, especially in summer.

Consequently agriculture, irrigation, handicraft industry are adversely affected in the area. Not only have that, lack of electric supply in summer in evening are responsible for lack of security of

women in the area. Distribution of Government health and sub-health centre is uneven in the area and in many villages people have to cover long distance to access health centre. The scenario is more problematic in rainy season, and for the pregnant women in the area where rural transport facility are not available Integrated Child Development Scheme (ICDS) Centre are plays very good role for the physical and mental development of the 3 to 6 years child, but in many villages the number of ICDS centre is less and consequently the child have to cover long distance to access the ICDS centre. Child have to travel on an average 20 Km distance by foot to access ICDS centre in Mahammadpur village and imagine the condition of child in rainy season on muddy, broken and water logged road. Not only have that distribution of primary school is not well in the area and primary school going children have to cover long distance to access primary school. The scenario is more problematic at Mahammadpur village. Distribution

of play ground in the entire geographical area is in rudimentary level Many villages exist in the area where play ground is almost absent, but play ground plays a very good role for mental and physical development of the young and adult in the area. So the school going students have to cover a long distance to access play ground. Cooperative and Gramin bank are plays very important role for reducing rural poverty and developed rural agriculture. But the distributions of Cooperative and Gramin bank are less in number in the area. Due to lack of proper number of these banks, different illegal agencies cheat with the rural poor. A disparity in rural services development is strongly prevails in the entire geographical area. Many villages where rural services development is well, but in many villages scenario of rural services are in poor condition. The development levels of rural services have been categorized into five classes These are as follows-

Table-5: Rural services development level of villages

Statistical range	Actual range	Development level	Village name
-6_1 to -6_2	7996 to 5561	Very High	Bagmari
\bar{x} to -6_1	10431 to 7996	High	Haripur, Kumarara, Naikundi, Jashnan, Namal, Fatehpur, Jamburbasan, Khajurberia
\bar{x} to $+6_1$	10431 to 12866	Medium	Dhitaibasan, Mahammadpur
$+6_1$ to $+6_2$	12866 to 15301	Low	Rautouri
$+6_2$ to $+6_3$	15301 to 17736	Very low	Mandergechia

Source: Prepared from table 4 and computed by authors

Table-6: Percentage of rural population benefitted in rural services development process

Development level	Number of villages	Percentage of village	Rural population	Percentage of rural population
Very High	1	769	1096	394
High	8	6152	16948	6089
Medium	2	1538	6229	2238
Low	1	769	870	313
Very low	1	769	2691	967

Σ 13

Σ 27834

Source: Census of India and computed by authors

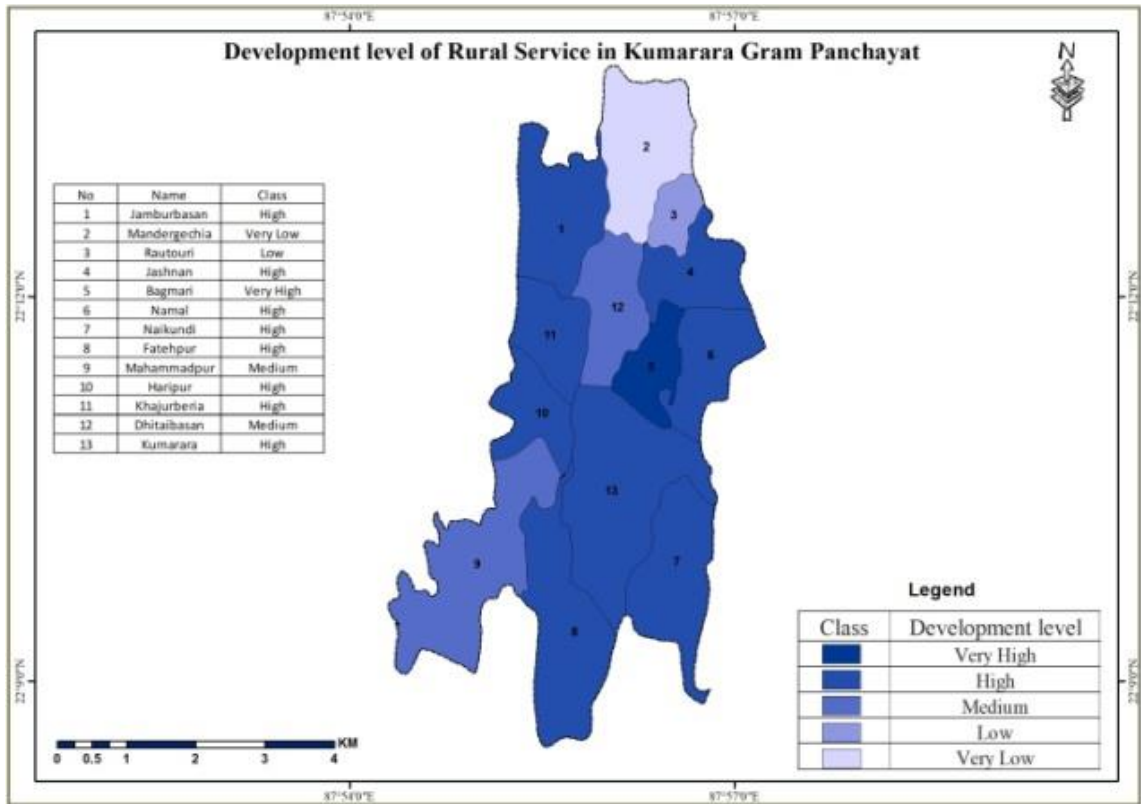


Fig.3: Rural services development level

I Very high developed region: In Bagmari village development of rural services is very high. In Bagmari village 74% people are access concrete road for their transportation. Not only have that large percentage of people’s (86.96%) of the said village’s access fresh drinking water for their daily livelihood. Peoples of the Bagmari village is cover very low distance to access the mandatory rural services ie, drinking water source, Government primary school, ICDS centre, Government health centre, play ground, cooperative and gramin bank, and rural market. Consequently the village comes under the very high developed region in rural services development. Out of 27834 rural populations, only 1096 (3.94%) population have been live in this particular area.

II High developed region: In the entire geographical area Khajurberia, Haripur, Kumarara, Naikundi, Jashnan, Namal, Fatehpur, Jamburbasan is falls in the high developed region in rural services development. Out of 13 villages, 8 villages (61.54%) belong in this category and 16948 (60.89%) population have been live in this particular area. In these villages availability of concrete road is well, large percentage of rural people’s do not face any problems to access fresh drinking water in different seasons, and people’s cover low distance to access the different mandatory rural services.

III Medium developed region: Dhitaibasan and Mahammadpur village are come under this region, and 22.38% population (15.38% village) have been live in this area Dhitaibasan village is familiar for

morum road. Muddy road and water logging on the road is the common problem of Dhitaibasana village in rainy season People have to travel on an average 202 Km and 20 Km distance to access primary school and ICDS centre in Mahammadpur village. So every rural service in mention two villages is moderate in nature and consequently development of rural services is in moderate level in that area.

IV Low developed region: Rautouri village in the Kumarara Gram Panchayat area are come under the

low rural services development region. Only 870 (3.13%) population live in the particular area. Seasonal crisis of drinking water is found in the area, and 100% people’s told that they face problems to access fresh drinking water in different season ie, summer and rainy. Not only have that only 50% people in the area are access the concrete and good condition road in different seasons. People are also travel long distance to access the Government health centre, cooperative and Gramin bank, and rural market in the area.

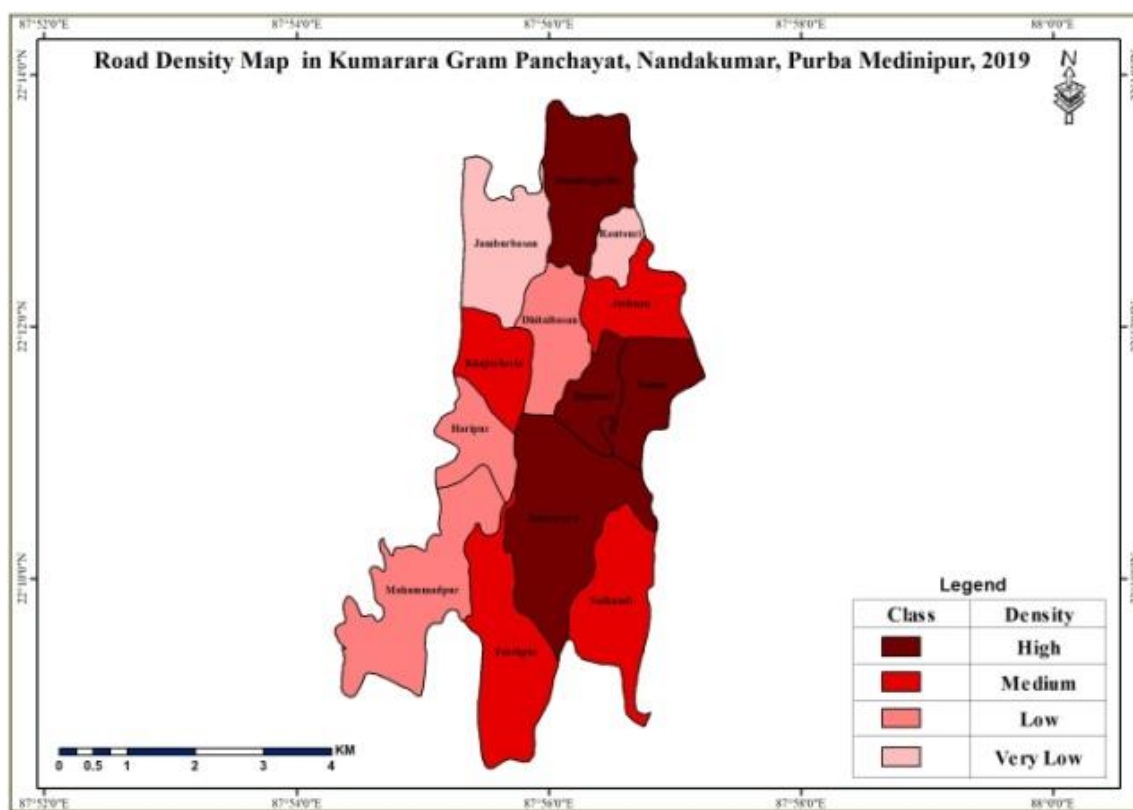


Fig.4: Road density map

V Very low developed region: All the rural services are in poor condition in the Mandergechia village. Only 2691 (9.67%) population have been live in this area. Only 44.44 % population are accesses the concrete road and good condition road

in the area. Rural road is very narrow in the area (55.56%). Absence of drinking water in Tubewell (44.44%), volatile water is come from Tubewell (44.44%) is the common problem in the area Not only have that in the entire geographical area

people's are also travel highest distance to access the drinking water source, Government health centre, cooperative and Gramin bank, play ground and rural market People in this area are travel near about 1 Km distance to access the drinking water

source. So the quality of livelihood of rural people's in this area is adversely affected and people of this particular village prevails their daily life without proper rural services.

Table-7: TAD, road density and Nested mean

Sl No	Village name	TAD in Km	Road density (Km/sqKm)	Cumulative rank	Mean	Nested mean
1	Bagmari	623	1216	32	$\bar{X} = \frac{\sum X}{N}$ $= \frac{622}{13}$ $= 4785$ N = Total no of frequency	$\bar{X}_1 = \frac{\sum X_1}{N}$ $= 3543$
2	Mandergechia	1403	1152	78		
3	Haripur	554	649	29		$\bar{X}_2 = \frac{\sum X_2}{N}$ $= 6043$
4	Kumarara	68	1241	515		
5	Dhitaibasan	931	538	645		$N = \text{Total no of frequency}$
6	Mahammadpur	944	535	52		
7	Naikundi	719	786	49		$N = \text{Total no of frequency}$
8	Jashnan	773	714	32		
9	Rautouri	1104	335	74		$N = \text{Total no of frequency}$
10	Namal	612	1212	35		
11	Fatehpur	85	827	41		$N = \text{Total no of frequency}$
12	Jamburbasan	876	421	54		
13	Khajurberia	591	906	30		$N = \text{Total no of frequency}$

Source: Computed by authors

Table-8: Accessibility level of villages

Class	Values	Village name	Village number	% of village	Rural population	% of rural population	Rural accessibility level
$< \bar{X}_1$	< 3543	Haripur, Khajurberia, Bagmari, Jashnan	4	30.77	5581	20.05	High
$\bar{X}_1 - \bar{X}$	3543 to 4785	Namal, Fatehpur	2	15.38	3941	14.16	Medium
$\bar{X} - \bar{X}_2$	4785 to 6043	Naikundi, Kumarara, Mahammadpur, Jamburbasan	4	30.77	13136	47.19	Low
$> \bar{X}_2$	> 6043	Dhitaibasan, Rautouri, Mandergechia	3	23.08	5176	18.6	Very low
Σ			13		27834		

Source: Census of India, 2011 and computed by authors

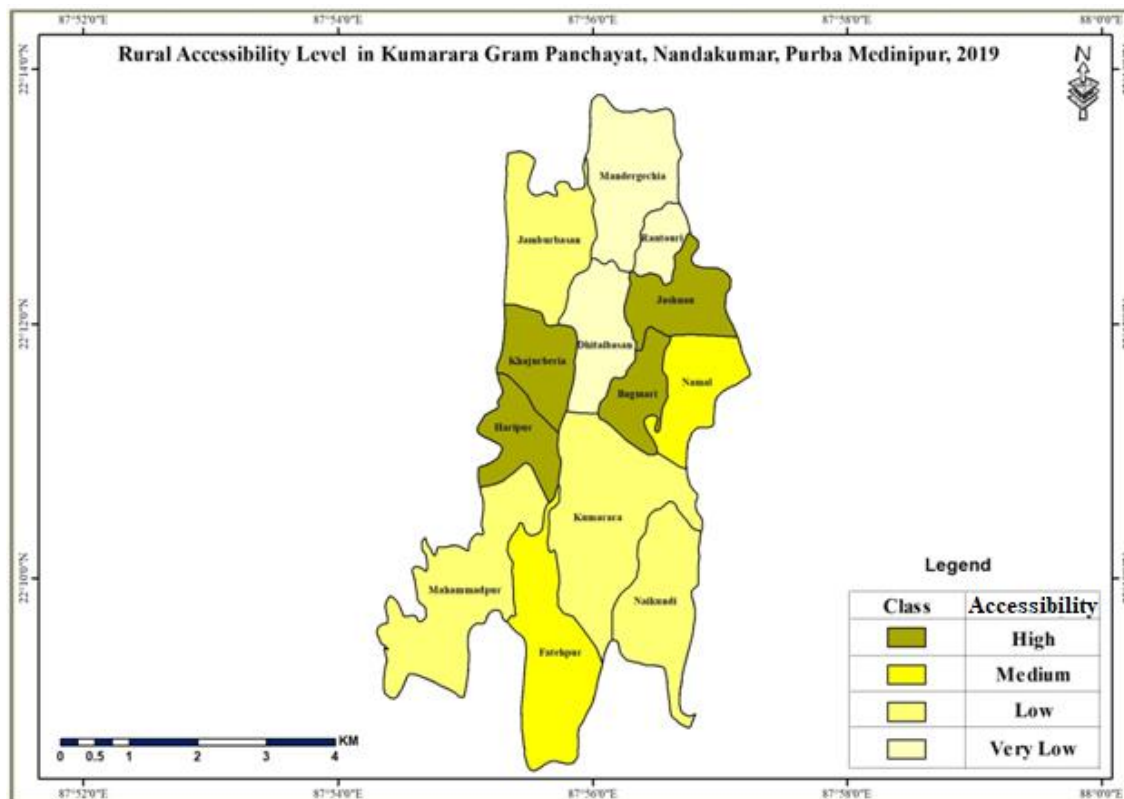


Fig.5: Accessibility level of rural services

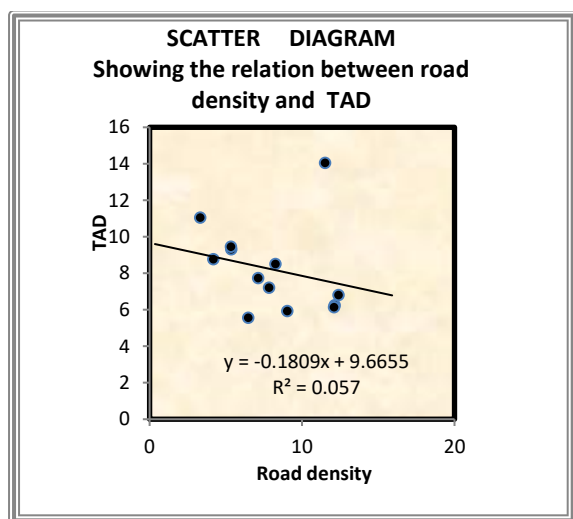


Fig.6: Relation between road density and Total Average Distance in Km

To highlight the accessibility of rural services we have considered the distance travel by the local people’s to access the services. We have considered here people’s travel average distance in Km to access the drinking water source, ICDS centre, primary school, Government health centre, play ground, cooperative and gramin bank, rural market. Total Average Distance (TAD) has been calculated of these variables and draw a scatter diagram to reveals the relationship between rural road density and TAD. The value of correlation coefficient between road density and TAD is – 0.2387 and this is highlighting the negative relationship between road density and TAD. This type of relationship is reveals that when rural road density increases, TAD decreases But the relationship is very weak here, that means road density in the entire geographical

area not strongly affects the accessibility of rural services. The said situation reveals the haphazard and unplanned distributions of rural services ie, drinking water source, ICDS centre, primary school, Government health centre, and cooperative and gramin bank in the entire Panchayat area. The best example is found in Mandergechia and Kumarara village, where road density is high but the villages belongs in poor condition in rural accessibility level of mandatory rural services. In Haripur and Jashnan village road density is not so well but both villages are come under high accessibility level in rural services. Only in two villages namely Dhitaibasan and Rautouri, where lack of rural road density are responsible for the low accessibility in rural services development. Cumulative rank has been considered for nested mean calculation and village-wise accessibility of rural services have been categorized on the basis of nested mean. Correlation coefficient between road density and cumulative rank is -0.27682 and said relationship is weak, and highlight the very weak relationship between rural road density and accessibility of rural services in the entire Panchayat area. Distribution and number of rural service centre are not proportional to the population and household density in the entire area such as in Rautouri village, where population and household density both is high but the village belongs in very low accessibility level in rural services.

Mean of TAD is 82 Km and standard deviation of TAD is 240 Km Combined mean of all variables is 112 Km. Combined mean is reveals that people's in the entire Panchayat area have to travel on an average 112 Km distance to access the every services to prevails their livelihood, and this is not very easy for each category people's especially old age group, child and primary school going students cover everyday to access the common services like safe drinking water source, ICDS centre, and primary school Long distance of the said services

from household is responsible for the dropouts from primary school; low literacy of female, physical harassment with girl child in the society.

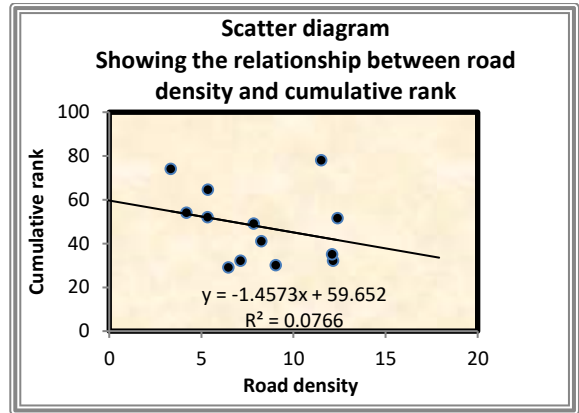


Fig.7: Relation between road density and cumulative rank

Table 8 in the analysis is reveals that accessibility of rural services in the entire Panchayat area. Accessibility is high in the Haripur, Khajurberia, Bagmari, and Jashnan village and very low in the Dhitaibasan, Rautouri, and Mandergechia village Haripur, Khajurberia, and Bagmari village have location advantage and number of rural service centre ie, drinking water source, ICDS centre, primary school, cooperative and gramin bank, market, Government health centre, play ground is also high, due to this accessibility level of rural services is also high in the said three villages. Accessibility of rural services is medium in Namal and Fatehpur village (15.38%); low in the Naikundi, Kumarara, Mahammadpur, Jamburbasan village (30.77%) Accessibility of rural services is high for the 20.05% people and very low for the 18.6% people's in the Kumarara Gram Panchayat area. The scenario of accessibility in rural services is threatened in the entire geographical area and 65.79% rural people have been lived in the low accessibility region of rural services.

Conclusion

Reduce the haphazard, unplanned, and unscientific process of rural development work is the solving approach of disparities reduction for the villages in the area Consider population density, total number of household, household density and total geographical area of the villages during the rural development work implementation time The said process reduced the haphazard and unplanned rural development work in village area Not only but also consider the accessibility of villages during ICDS centre, primary school, cooperative societies and Gramin bank, health centre construction time inside

the villages The said process reduces the distance of these service centres from household and accessibility of rural services will be increases in future in the area Overemphasized is needed on the construction of new black topped, cemented road in the villages and the said approach will enhance the rural road density in the entire area and indirectly increase the accessibility level of different service centre for villagers Need extra care, attention and extra funding for the deprived region or villages to enhance the rural services development and improving the rural quality of life.

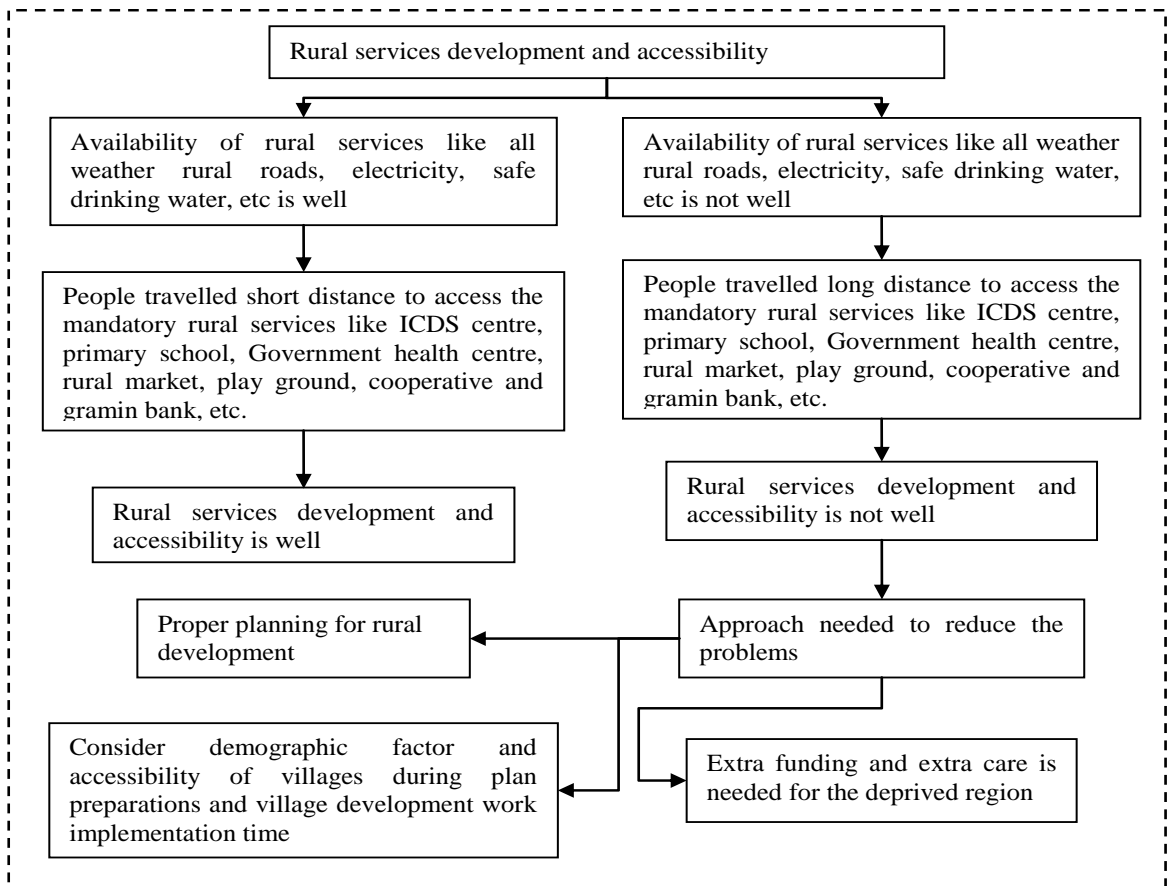


Fig. 8: Model of summary of work regarding rural services development and accessibility of rural servicers, and needed approach to enhance the rural services and accessibility of rural services

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Dimension of Female Non-Working Population Among Different Religious and Ethnic Groups of Ausgram Block-I, Bardhaman District, West Bengal

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Abstract

Proportion of female non-workers in Indian rural societies very much depend upon their social status and economic background or their position in the caste / social hierarchy. In the patriarchal society, with the help of socio-cultural restrictions, women of the upper social segments are prevented in taking part in available rudimentary economic activities, due to their better financial background and very high 'traditional social status'. These results very high proportion of female non-workers among upper caste/ social segments. They are forced to engaged in various household activities. This picture is totally different among the women of the lower segments. Due to financial requirements and absence of socio-cultural restrictions a large number of them are compelled to take part in economic activities and very few women of them remain as non-workers. Other than these factors, non-availability of economic activities (both high salaried and low-paid wage based economic activities), structure of the society, implementation of government policies (regarding women employment), development of transport and communication system play an important role in determining proportion of female non-workers in the rural areas of this rural block. This research work is based upon both secondary data (from Census of India) and household survey based primary data. For

analysing data percentage and correlation and regression are used.

Keywords: Female non-workers, Patriarchy, caste / social hierarchy, agricultural economy, socio-cultural restriction.

Introduction

In traditional rural hierarchical Indian societies female working and non-working status very much depend upon their socio-economic background rather their position in the caste / social hierarchy. Among all the castes, the kitchen was the recognized sphere of feminine activity. (Srinivas : 1988, P-153). Along with the household work, the women perform economic and beneficial work through engaging in kitchen garden, poultry, dairy, free collection of fish and fire wood (Kalpagam : 2011, Page - 30 & 32). In the patriarchal society, male members are suppose to take the responsibility of maintaining the family. According to this norm the male members of the upper social segments (very broadly the Brahmins, Kayastha and middle ranking Vaishya among the Hindus and 'Sarif' or 'Asraf' among the Muslim) take full responsibility to maintain their family. Even those who are not in the position to earn sufficient amount of money, the women are not allowed to part in earning due to their "higher traditional social status", which is operated through various socio-cultural restrictions. This

picture is very much different among the people of the lower segments (Scheduled Castes, Scheduled Tribes and 'Atraf' of 'Ajlof' Muslims). Male member's scanty income and absence of income from the other sources make these people very poor. In such a situation financial help from the female members became necessary for maintaining their family. Absence of socio-cultural restrictions against their participation in economic activities and extreme economic urgencies did not give scope the women of this lower segment (specially from the Scheduled Castes and Scheduled Tribes) other than earning from labourious low income occupations. This results, lower proportion of female non-workers in this lower castes / social segments in the rural areas of this block.

Objective of the Study

Main objective of this research work is to narrate the pattern of female non-workers among different castes of the Hindus and among the Muslims and also among the Scheduled Tribes. Another important objective is to identify the reasons for not participating in economic activities by the women of the different castes and religious and ethnic groups. Another important objective is to see the relation between the family resource and female non-working status.

Database and Methodology

For this research work both primary and secondary data are used. Secondary data are collected from Census of India 2001. From the highly developed Bardhaman district of West Bengal, Ausgram Block-I has been selected on the basis of population composition. Depending upon population of different castes, religion and ethnic groups and even distribution of villages within the block, different villages are selected. Among these villages houses of different castes,

religion and ethnic groups are randomly selected. With the help of prepared questionnaire required data and information are collected from the selected households. For this research work percentage and correlation and regression are used for analyzing the collected data and information.

Study Area

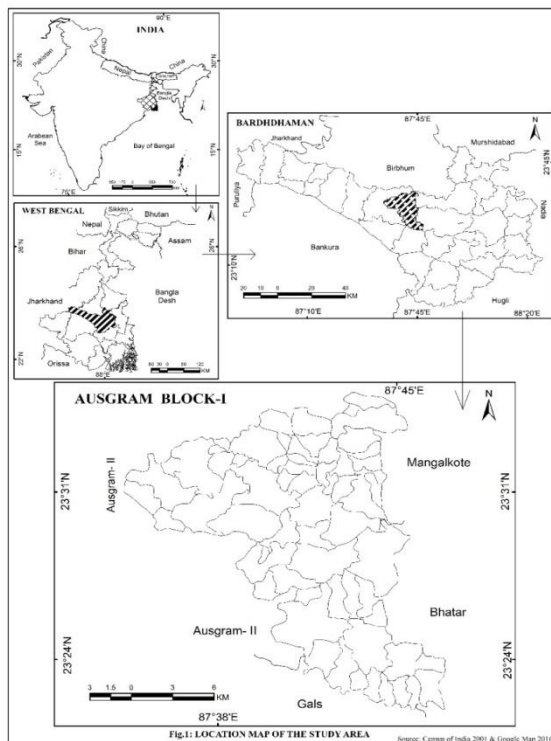


Fig. 1: Location of the Study Area

Ausgram block - I of Bardhaman district of West Bengal has been selected as a study area of this research paper. This highly developed multi cropped agricultural region produce both cash and food crops. Agriculture is the main occupation of the most of the people. Literacy level among the people is quiet high. Though the villages of this block are well connected with road ways, but due to high cost of transportation poor people can not afford it. As

a result these villages remain isolated in the far off remote areas and remain cutoff from the rest of the world. This very old civilization have very rigid orthodox structure, where caste / social hierarchy is very prominent. In such societies all sorts of resources are distributed according to their position in the caste / social hierarchy. Due to location, this area remain undisturbed for a long period of time. People from different castes, religion and ethnic groups are staying together. Total rural area of this block is 222.3 sq. k.m. and total rural population is 106850 persons (Census of India 2001).

Discussion

In this research paper at first proportion of female non-workers among different castes / social segments will be discussed. From the primary survey based statistical table it is observed that maximum female non-workers are found among the Brahmins (92.31%) followed by Vaishya (84.62 %), Kayastha (83.33 %), Scheduled Castes (48.78 %) and Scheduled Tribes (27.27 %). A sizeable proportion of Muslim women (63.33 %) also do not take part in economic activities.

From this data it is clear that percentage of female non-workers varies from one segments to another depending upon their socio-economic background. In this rigid social structure female non-working pattern more or less follow age old case / social hierarchy.

Maximum female non-workers are found among the socially most prestigious and economically also well off Brahmins. In this orthodox society the people are so conscious about their social status, that even the poor Brahmin women do not go for earning from available rudimentary low wage based occupations, which may lower down their existing social status. For this reason

proportion of female non-workers are maximum among them. 2nd large number of female non-workers are found among the 3rd ranking Vaishyas. From the other studies also it has been found that these people have strong desire to move upward and absence of socio-cultural restrictions help them to do so. As a result both comparatively better off economic condition and adoption of the culture of the higher castes, Vaishya women also do not take part in economic activities. A large number of 2nd ranking Kayastha women also do not go for earning due to higher economic and 'traditional social status'.

Totally different picture is found among the women of the lower segments. Economic urgencies and absence of socio-cultural restrictions did not allow most of the Scheduled Castes and Scheduled Tribes to engage only in household work. Though participation in part-time economic activities at home reduce the number Muslim female non-workers, but practically proportion of female non-workers are high among them.

Reasons for not taking part in Economic activities by the Women

From the field work it has been found that the proportion of female non-workers are very much different from one social segment to another. There are various social and economic reasons behind such pattern Some important reasons are discussed here :

(i) Well off Economic Background:

There are some women in these villages of this block, who do not take part in economic activities due to their well off economic background. Such women non-workers are

Table – 1: Percentage of Female Non-Workers and Reasons for not Participating in Economic Activities : Ausgram Block - I

Caste / Religion	Percentage of Female Non-Workers to Total Female Population (15 - 60 Years)	Well-off Economic Background	Family / Social Background	Too Much Family Work	Non-Availability of Prestigious Occupations	Ill Health & Tiredness due to Previous excessive Work
Brahmins	92.31	15.68	7.69	23.08	46.15	0
Kayastha	83.33	16.67	0	50.00	16.67	0
Vaishya	84.61	23.08	0	30.77	30.77	0
Scheduled Caste	48.78	0	0	43.90	0	4.88
Scheduled tribe	27.27	9.09	0	6.06	0	12.12
Muslim	63.33	0	23.33	36.67	0	3.33

Primary Survey : 2014

maximum among the Vaishyas (2308 %) followed by Kayasth (1667 %), Brahmin (1568 %) and lastly by the Scheduled Tribes (909 %).

It has been already stated that the middle ranking Vaishya people have improved their economic standard much and do not require financial help from the women for maintaining their family. It has been also found during the field work that the well off and educated two upper castes have left these 'remote' and 'underdeveloped villages' to the urban areas. This reduces the number of rich upper castes in these villages. As a result proportion of women workers in this category has come down among the two upper castes.

Among all the women of the lower segments, only very few Scheduled Tribes women fall into this category. These people want to 'Sanskritized' themselves. Field survey shows that some educated Scheduled Tribes male persons got government jobs (with the help of Constitutional Safeguards) and able to improve their economic standard. These people do not need financial help from the women for maintaining their family and like

the women of the mainstream of the village society they also do not allow their women to take part in economic activities.

There are no women among the Scheduled Castes and 'Atraf' Muslim who fall into this category. As except some tribal people most of the poor women of the lower segments don't rid off earning from laborious economic activities.

(ii) Socio-cultural Restrictions Prevent Women to take Part in Economic Activities :

From the field data it has been found that only 7.69 % Brahmin women are not allowed to take part in economic activities due to strong socio-cultural restrictions. These orthodox top ranking Brahmins are very much conscious to maintain their age old higher position. They always try to keep the Brahmin women much above all the other women of the society and prevent participating in available economic activities (both outdoor and indoor) like the common females of the village with the help of different socio-cultural restrictions. In the traditional societies the women are given education, but they are prevented in entering into outer world.

Even in the modern societies prejudices of mythical world survive (Kalia : 2005, Page - 37). It is also true that these people do not believe in women empowerment through economic independence. No other castes Hindus have such attitude towards the women of their family and give permission to be self dependent economically.

The Scheduled Castes and Scheduled Tribe women of the lower segments do not face such problems. Due to very poor social status of the Scheduled Castes, no socio-cultural restrictions are made to prevent them in taking part in economic activities, rather these women are worked for the benefit of the upper castes. Women of the lower strata have to take up work to meet the family expenses and this necessitates their movement outside the precincts of the domestic group and this regulations apply more to upper and middle level families (Dube : 1990, Page - 107).

The situation is different among the tribal women. In the tribal society patriarchy is not very pronounced. The tribal women take much economic responsibility and work in the forest and agricultural field with considerable freedom of movement in the society (Dube : 1990, Page - 109).

A large number of Muslim women (23.33 %) also face the problem of socio-cultural restrictions in participating economic activities. Practice of 'Pardah' system and strong socio-cultural restrictions forced them to stay within the four walls of the house. Orthodox Muslim society does not allow a large number of women to be self dependent economically.

(iii) *Excessive Pressure of House Hold Work* : Desai and Thakkar (Desai and Thakkar : 2011. Page-18) have given a miserable picture of pressure

of women's work. Women work all the time, all the day and there is no escape from the grind of work performing both economic and non-economic activities within home. In the agricultural economy of the rural areas of our country both production and consumption units are found together at home. In the traditional society the responsibility of all the household work are imposed upon the women. In the rural areas most of the family have large family members and most of the houses belong to the domestic animals like cows, goat, pigs, chicken, duck etc. (depending upon their socio-economic status). Since the early morning they start work like parboil paddy and make them dry, rearing children, look after old and sick persons, cleaning home and wash utensils, cooking food (Sometimes for the labour also), cleaning animal shades, fetch water, (poor women) also go to collect fuel, fodder, food items and so many other work till mid night. They maintain the kitchen garden and help the male members in performing their economic activities. They get up from sleep before every family members and go to bed after all the family members. Though the rich women get helping hand, but the poor women don't get so. Social norms are imposed upon the women in such a way that they are bound to do all these responsibilities. They do not escape from such huge responsibility and they even do not get rest. In such a situation they don't think to engage in economic activities for a long period of day time, leaving all these work.

The Muslim women also face the same problems. They have to take the responsibility of small children and other family members along with all the other household work. From the field work it has been found that even they get time the male members do not allow them to go out and forced them to engage in household work only within their home only.

(iv) Non-availability of 'Prestigious' Occupations in the Nearby Areas :

M. N. Srinivas (Srinivas : 1988, P- 153) has shown in his study that, women's participation in agricultural work is determined by the income of husband and the nature of sanskritization of life. Even the male members of the rich family are prevented from participating personally in agricultural activity. In such a situation women of the upper castes /segments can't even think to participate in such economic activities. 'Clean' and 'noble' occupations raise a jati in a higher position (Dube : 1990, Page - 55). In the rural areas educated, trained and skilled women face this problem much. In the agricultural economy of the rural areas it is difficult to get salaried, non-primary so called 'prestigious' occupations. Joining in such occupations raise their socio-economic status. The women mainly from the upper social segments are not willing to join in rudimentary, low-paid, wage based occupations, which may 'degrade' their status. Rather than joining in such occupations the women of these segments remain unemployed. Women remain non-workers due to non-availability prestigious occupations are maximum among the Brahmins (46.15 %) followed by Vaishya (30.77%) and Kayastha (16.67 %). From these data it is clear that educated women of the upper castes face this problems. The reasons have been discussed in previous paragraphs. The educated women are looking for non-manual work and are not ready to do the work that 'soil their hands' (Myrdal : 1968, Page - 51). It is also found that even the illiterate or low educated women from the upper caste / social segments also willing to join in such above mentioned occupations. As a result a large number of women of the upper segments remain unemployed due to above mentioned reasons.

This statistical table also shows that women of the lower segments do not face such problems. As most of them are illiterate or vary low educated and do not have any social status. So in their economic urgencies they do not heisted to join in available so called 'low prestigious' wage based rudimentary occupations. As a result in this block no women of the lower segments remain unemployed due to the above mentioned reason.

(v) Ill Health and Tiredness prevent the Women to Take Part in Economic Activities :

Some Women of this block could not take part in economic activities due to ill health and tiredness. Such women are found among the Scheduled Tribes (12.12 %), Scheduled Castes (4.88 %) and also among some Muslims (3.33 %).

These data shows that women of this category mainly belong to the lower castes / segments of the society, who are socio-economically very poor. Due to extreme economic urgencies and lack of socio-cultural restrictions, some (mainly Scheduled Caste Scheduled Tribe) very poor women are forced to start earning from their early younger ages for giving financial help to their family. Throughout their working period they were engaged in various laborious manual work with scanty income. Moreover repeated childbirth and excessive pressure of household work make them physically very weak. These women do not get proper food and also medicines at the time of requirements, rather they give up these for the shake of their husband and children.

All these aspects not only make them physically very weak, but also make them vulnerable to various diseases. In such a situation physically unfit women could not take part in economic activities.

Such women are mainly found among the women of the lower segments and not at all found among the women of the socio-economically developed upper casts / social segments, as they do not face the above mentioned problems.

Relation Between Family Resources and Female Non-Workers

The researcher seeks to see whether there is relation between family resources (both fund and cultural resources) and female non-workers or not. Family resource reflects socio-economic status of the people. The people of the upper castes/ segments generally possess enough resources and still now have sufficient resources. The Scheduled Caste people do not have land to cultivate, not have much capital for starting business or small household industry or have requisite education to be absorbed in service (Mohammad : 2006, Page - 96). Here some of the family resources and female non-workers are discussed :

1. Relation Between Income of the Male Members of the Family and Female Non-Workers :

In patriarchal Indian society male members earnings determine family's economic and social status. Broadly male person's income are classified into two groups :

a) Correlation between male members with high income and percentage of Female Non-workers :

It has been already stated that in the hierarchical social structure of the rural areas, income of the male members depend upon their position in the caste / social hierarchy, as such position determine male members' educational background, training, skill etc. Correlation between percentage of male members in high income and percentage of female non - workers is

moderately positively correlated and co-efficient of correlation is + 0.50 . It proves that with the increase of male members income requirements of the financial help from the female members reduced. The female members of the upper segments do not take part in economic activities as the male members earn sufficient. All the male members of the upper segments do not earn much, still the women members of their family do not take part in economic activities. For this reason value of correlation of co-efficient is moderately positive.

b) Correlation between male members with low income and percentage of Female Non-workers :

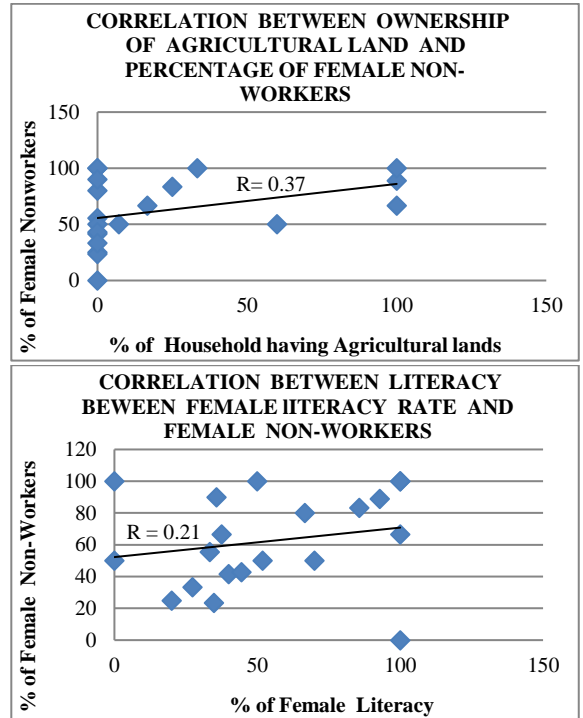
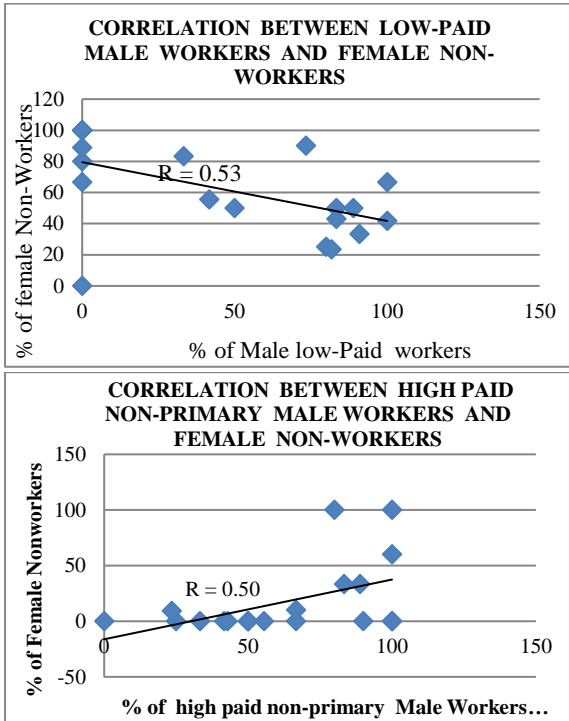
Correlation between these two aspects is moderately negatively correlated and co-efficient of correlation is - 0.53. It again proves that with the decrease of male members income requirements of financial help from the females raise. Income of the male members of the lower casts / social segments is low, For this reason the women of these segments take part in economic activities for providing financial help to their family. Absence of socio-cultural restrictions and poor educational background allow them to absorb in available rudimentary occupations. It is also true that participation of poor Muslim women in part-time economic activities results such moderate value of co-efficient of correlation.

2) Correlation between percentage of Household with agricultural Land and percentage of Female Non-workers :

In the rural areas agricultural land is considered as one of the most important resources of the family. As in the primary economy agricultural land is not only the main source of income, but also determine social and economic status in the society. In the rural areas people had a tendency to possess

agricultural land as large as possible. In this block correlation between ownership of agricultural land and percentage of female non-workers have weak positive correlation and coefficient of correlation is +0.37.

possession of agricultural land could not improve the socio-economic status of the people.



Based on Primary Survey : 2014

From the study of Dr. Biswas (Biswas : 2008, unpublished Research work), it has been found that after independence age old landless Scheduled Caste and Scheduled Tribe have got small, non-fertile and uneconomic sized agricultural land, which could not raise their socio-economic standard. So though number of persons with agricultural land has increased, but that could not reduce the requirement financial help from the women. Situation is different among the people of the upper segments. These land rich people normally do not require financial assistance from the women of their family. For this reason these two criteria have very weak positive correlation. So only

3) *Correlation Between Female Literacy and Female Non-Workers :*

Education is considered as one of the most important resources of the people. Literate people only can only able to be educated. These two aspects are very weakly positively correlated and coefficient of correlation is +0.21. From these data it is clear that the poor women of the lower segments became only literate (with the help of Government policies), but could not reach to the higher education level. So this literacy could not became a powerful resource in the poor family. As a result socio-economically poor literate women of the lower segments have to take part in any type of economic activities. Whereas women of the rich family go to the higher education level and do

not participate in economic activities. For these reasons these two aspects are very weakly correlated to each other.

Conclusion

In patriarchal hierarchal rural agricultural societies, proportion of female non-workers depends upon their position in the castes / social hierarchy or their socio-economic background. In such a societies maximum female non-workers are found among the socio-economically developed upper castes / segments and very low in the lower segments. So in hierarchal society such proportion of female non-workers more or less decrease from upper segments to lower segments. The upper caste women and lower caste women remain as non-workers totally for a different reasons. The women of the upper segments do not take part in economic activities mainly due to well off economic background and non-availability of 'prestigious' salaried non-primary occupations. Except very few cases no women of the lower segments are found in this category. As most of them are very poor and for providing financial help, the women of the lower segments do not have any option other than earning from available very rudimentary low-paid wage based economic activities. Socio-cultural restrictions are imposed upon the orthodox top ranking Brahmin women to prevent from taking part in economic activities like the ordinary women of the lower segments. No Hindu women of other castes face this problem. A sizeable proportion of orthodox Muslim people also prevent women of their society in taking part in economic activities by imposing socio-cultural restrictions and 'Purdah system'. Considering the socio-cultural environment and economic structure of the of the rural areas a sizeable proportion of the women are kept

engaging in household work. Though proportion of such women non-workers are more among the lower segments than upper segments, as the rich women can afford to have helping hand, that the women of the lower segments can't.

With the increase of male people's earnings, number of female non-workers increase or vis-a-vis. Though simply possession of agricultural land (specially among the Scheduled Castes and Scheduled Tribes) and only literacy level could not have much influence upon determining number of female non-workers among different social segments.

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Feminisation of Agriculture: A Case Study of Telkoi Block of Keonjhar District, Odisha

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Abstract

India is a country having culturally rich from thousands of year dominated by male in every sphere of life. Women have neglected since ancient time and mainly confined to the activities within the four walls of houses, but women have started to predominate role in present day due to large scale cultural transformation. Today large numbers of women are engaged in the agricultural, allied activities and its value chains. Creation of large number of Women Self Helps Group many activities involving women are undertaken by both government and social organisation in India to make women self-reliant. Many training and capacity building program are undertaken as a result today women are able to involve them in the agricultural activities in the rural area. This research paper focus on the participation of women's in the agricultural activities of the tribal dominated Telkoi Block of Keonjhar District, Odisha.

Keywords: Feminisation, Cropping Intensity, Agriculture.

Introduction

The term “Feminisation of Agriculture” indicates the increasing number of women in agriculture. There is an increase in the percentage of women in agricultural activities either as self-employed or as

wage workers or unremunerated family workers relative to men. The number of both men and women in agriculture has declined, but the rate of decline has been more among men. As a cultivator, the number of women has declined; however, their numbers have increased as agricultural labourers. According to data, in India, around 84% of women depend on agriculture for their source of revenue. As per census 2011 data, out of total female workers, 55% were agricultural labourers and 24% were cultivators. Food and Agriculture Organisation (FAO) says that in India, Women's contribution to agriculture is about 32%, while in some states their contribution is more than men. According to Research done by Indian Council of Agricultural Research (ICAR), the participation of women in the production of major crops is 75%, in horticulture 79% and post-harvest work 51%.

Study Area

Telkoi block of Keonjhar district, Odisha has been selected as the area to be studied. It is located on coordinates 21° 21' 32.4" N and 21° 21' 32.4" E and surrounded by Angul district on the west, Dhenkanal district in the south, Harichandanpur block on the East and Bansapal block in the North.

Out of the total geographical area of 91506 hectares, the total Net sown area is 15650 hectares and Gross cropped area is 21357 hectares. Cropping intensity is 136.5%. Agriculture is the prime sector which

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provides livelihood to nearly two-thirds of the total workforce in the block. Paddy is grown as the major cereal in the block. Along with paddy green grams, black grams, urad dal and sunflower are also grown. In winter watermelon is cultivated in irrigated lands, mainly through pump irrigation.

and science of farming. Earlier the agricultural sector was mainly associated with men. Now the image has been feminised. They perform various activities like sowing, weeding, transplanting, irrigation, fertiliser application, harvesting, winnowing, storing etc. They also participate in allied activities like cattle management, fodder collection, milking etc. In winter, they grow vegetables like cabbage, cauliflower, beans, brinjals, chillies etc for their consumption or to trade locally. Apart from this mung, urad, kulthi are grown mainly by women labourers along the river bank of Hanumatia and Samakoi.

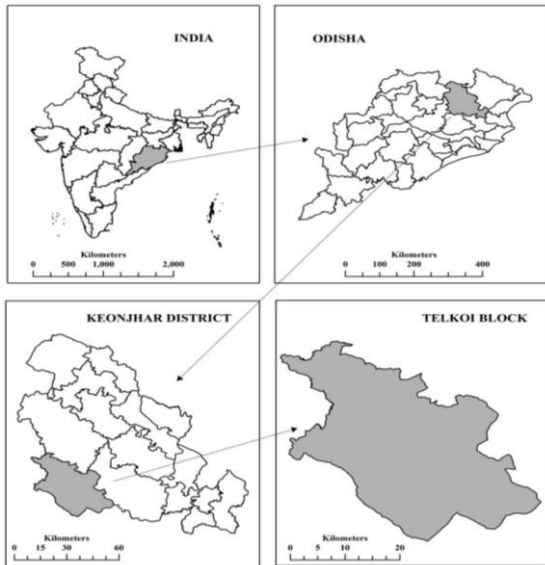


Fig.1: Location of study area

Data base and Methodology

A Total number of 350 households from different villages were selected and surveyed. The research is based on primary and secondary data. Primary data has been collected through the questionnaires’ survey and from official documents. While secondary data sources were books, journals, theses, internet sources and reports. The data has been analysed with both qualitative analysis and quantitative methods by using the different statistical application, which corresponds with graphs and charts.

Discussion

The famous agricultural scientist, Prof. Swaminathan, describes that woman was the first who domesticated crop plants and initiated the art

Rural women are engaged in agricultural activities in three different ways. They are work as:

- Agricultural Labourers
- The Cultivators who work on their land
- Manager of farm activities by way of labour supervision and participation in post-harvest operations

Out of the total main workers, 56 percent were agricultural labourers and 38 percent were cultivators. However, only 6 percent of the total women supervise farm works.

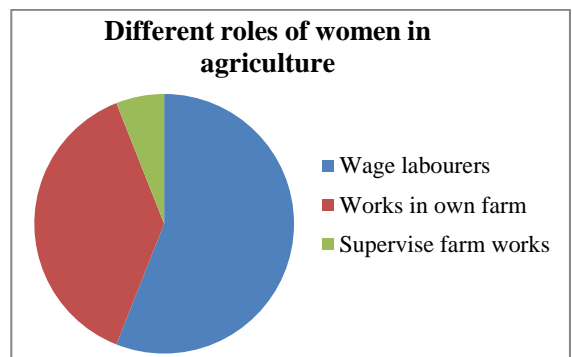


Fig.2

Source: Primary data from field survey

Uncertainties in agricultural output are increasing with increasing temperature, frequent heat-waves

and irregularities in other climatic factors. Due to which the number of youth male out migration is increasing. With the absence of the male person in the family, the women are coming forward to fill the space. In 2015 there were 84 per cent of women engaged in agriculture, while the percentage has increased to 91 in 2019.

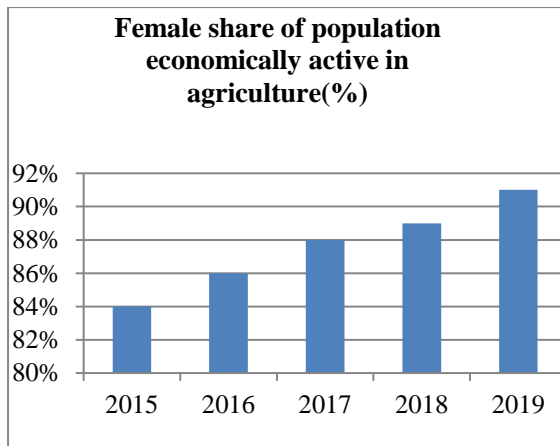


Fig.3

Source: Primary data; From Field Survey and Village Panchayat Office

Causes of feminisation

Male migration- Migration is an important factor which has played a significant role in increasing the number of women into agriculture. Men out migrate to urban areas to find better avenues for income. Mainly the migration is to Surat, Chennai and Mumbai. Most of them are low skilled or semi-skilled workers who work there in industries like food processing, tobacco, textiles, apparel, leather, wood and furniture etc. Also, many of them are working as security guard, waiter, flight attendant, taxi driver etc. In the absence of the male person in the family, there has been an increase in participation of women as labourers, cultivators and entrepreneurs.

Poverty- More than 70% of the total population of the block are below the poverty line which has forced the women to work as agricultural labourers to supplement the family's income. Women also work as unpaid workers in their fields.

Mechanisation of agriculture- Increasing mechanisation of agriculture cause the men to move to other non-farm activities. On the other hand, women have to confined to traditional roles such as sowing, transplanting, weeding, fertiliser application, harvesting, winnowing, storing etc.

Mobility- Due to low level of skills and societal restraint, the upward mobility of women for employment is restricted. Even if they work much longer hours than men, are paid lesser than their counterpart. Census data says the percentage of migration for employment in case of rural males is about 33.7%, while it is very low i.e. 3.6% for rural females.

Low level of skills- Female literacy is less than the national average in these villages. Women are mainly low skilled or semiskilled. So they have to face various problems while operating agricultural chores. Many of them don't have property rights. So they lack bargaining power against the property holding male members in the family, which resulting in there higher involvement as agricultural labourers.

Challenges/concerns

Access to land- Women have limited access to land. Only 5 per cent of women own land. Absence of land ownership leads to poor economic status and lack of financial independence. On average, in a crop season, while men spend only 1900hours in the field, women spend nearly3400 hours. Still, women are not officially counted as farmers. As per 2011 census, only 32.8% of women are formally listed as

primary workers in the agricultural sector against 81.1% men.

Access to credit- Due to lack of land ownership rights, women find it difficult to avail loans and subsidies, bargaining for MSPs. The primary survey data indicate that in Telkoi block 62 % of women report difficulty in assessing credit and savings. Nearly 77 % of women own a bank account but 58 % of accounts saw no deposits or withdrawals in 2019. The share of females in the total deposited amount is 11 %.

Access to resources- In comparison to men, women have less access to modern inputs like seeds, fertiliser and pesticides. Due to social resistance, women are not so active in outdoor work as compare to their men counterpart, so they unable to intensify their agriculture with additional inputs.

Access to technology- With increasing mechanisation of agriculture, women have been confined in low paying traditional works. Further, most of the machinery is unaffordable and difficult to operate for women. As per primary survey data 78percentage women do not know the use of modern machines in farming, do all the work manually.

Access to education, agricultural training has been low for women as compared to men. According to 2011 census, the total literacy rate of Telkoi block is 6579 percentage. The male literacy is 6496 percentage while the female literacy is 4751 percentage. Uneducated women are most likely to fear change and cling to ancestral tradition, as they see it. There is lack of agricultural training, so most women do not know which crop to grow in which soil, how much fertiliser is right for which crop, how to avail credit from the bank, how to use modern machinery and how to get the right value for their products 75% of women in the block do not

know the use of machines in farming 60% of women not able to calculate how much production has been done in their farming.

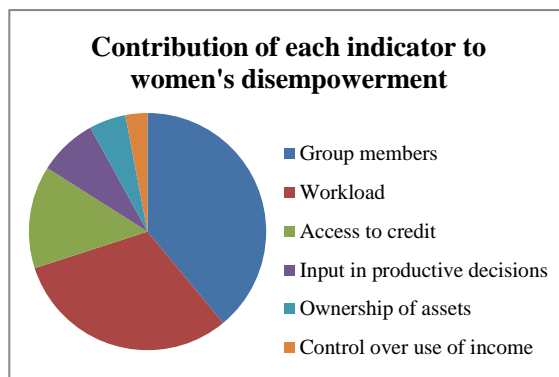


Fig.4

Source: Primary Data; From Field Survey

Managing different roles- Along with agricultural works, they have to fulfil domestic obligations like child-rearing, cooking, washing, fuel wood gathering, household maintenance. So they could not pay much attention to farming work.

Wages-For the same work women workers have been paid lesser than male workers and many of times remain unpaid. For 6 hours working where men labourers get ru200, women get ru160.38% of women work in their farm land whose do not get any remuneration.

Marketing-The small and marginal women farmers lack adequate access to sufficient market information about inputs, prices, consumer demands and competitors. There is lack of literacy, information and knowledge among them. Also, they don't have representation in agricultural marketing committees and other similar bodies.

The feminisation of agrarian distress-The number of women is increasing in agriculture, not because those people are coming in their own free will. The

women with limited alternatives of livelihood have been forced to undertake agricultural activities that have been left by men due to agrarian distress. Every year around 6000-7000 men are migrating to other states to work on daily wages. Due to lack of training, long working hours and lack of nutritional intake, many times they have to face health hazards.

Conclusion

Women have started to predominate in every level of agriculture and its value chains. The department of Agriculture, Cooperation and Farmers Welfare implements various programmes for the upliftment of women in the agriculture sector. There would be at least 30% of the budget allocation for the benefit of women farmers. To enhance women participation and productivity Mahila Kishan Sashaktikaran Pariyojna(MKSP) Scheme is there. Under National Food Security Mission women farmers are provided with Cropping System based training to increase production and productivity of crops. To make women self-reliant, they are organised into Self-Help Groups (SHGs) which will help them in capacity building and ensure their representation in different decision making bodies.

The issues should be deal with gender- specific interventions. The women should be ensured with access to land and property rights. Women should avail easy credit without collateral under the micro-finance initiative of NABARD. Rural women should be provided with training about modern agricultural techniques. Equal pay for equal work should be ensured for women farmers. Rural women should be provided with choices of occupations so that they don't have to do the work left behind by men. Thus, it is important to have overall empowerment of women through education, awareness and doing away with gender biases.

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An Analysis of Socio-Economic Status of Gajapati District of Odisha

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Introduction

Society is an amalgamation of diverse elements. Ethnically differentiated communities, caste groups, language, religion having a wide variation in social organization, cultural pattern, material culture make a society and particularly the Indian society. The tribals and non-tribals, Hindus, Muslims, Christians and other religions, the versatility of languages and dialects all make India a kaleidoscope of social elements ultimately making the singularity of a society. "Social geography" is an analysis of social phenomenon as expressed in space. Social phenomena encompasses the whole framework of human interaction with environment, leading to the articulation of social space by diverse human groups in different ways." (Ahmed, 1999 p. 21, 22). Social Geography has an ascent origin compared to other branches of geography. The view of social phenomena is all embracing and holistic, based on the totality of human interaction with environment. Eyles visualized social geography as a continuation of the philosophy of Vidal de la Blache and Bobek: It stresses both the humanistic nature of the geographical world and the classificatory nature of human geographical work." (Johnston et al, 1981 p. 309). In an India context it is important to quote MoonisRaza here: 'the sociologist or the anthropologist the economist or the political scientist, tied down as they are by the tools and concepts developed in their disciplines, generally ignore the regional dimension, which in the context

of a large landmass like India, is of crucial importance. The geographer can provide the necessary corrective". Ahmed while commenting on gaps in research in social geography, considered it to be more of an act of commission rather than omission and lamented social geographers' lack of interest in casting the spatial dimension into a historical mould. (Sharma, 2004 p.1120). Nayak was critical of social geographers remaining by and large immune to changing socio-economic realities in analyzing manifold impacts of globalization and liberalization on peasants, the toiling masses and other socially marginalized segments living in rural and urban areas. (Nayak. 2015). Most of a better social geography of India. The contemporary scenario in the social geography of India encompasses the study of tribe, caste, language, religion, displacement, social and spatial exclusion, women and gender, poverty, quality of life and levels of living. The present study is an attempt to understand the different elements of social geography in a sensitive and backward district of Odisha.

Objectives

1. To study the distribution and characteristics of different tribal groups in the district
2. To analyze the caste structure
3. Analysis of language and religions structure
4. Analysis of economic relations, gender and quality of life

Methodology & Database

It is an empirical study based on both qualitative and quantitative data collected from secondary sources. The data has been collected from published govt. sources like gazeteer, statistical handbook and census publications.

Study area

The study area is Gajapati district a former princely estate with rich historical, political, cultural and natural resources, carved out of erstwhile Ganjam district on 2nd October 1992. The district extends from 18°46' N to 19°39' N latitude and 83°48' E to 84°46' E longitude with an area of 4325 sq.km. (02% area of Odisha). Morphologically it runs from NE to S direction with a bold relief, rugged terrain and steep slopes in northern and central parts of the river valleys and plains to the south. The river Vamshadhara passes along the western boarder of Kashinagar block and river Mahendratanya flows close to the Paralakhemundi town. The administrative set up comprises of 01 subdivision, 07 Tahasils, 07 blocks out of which 05 are T.S.P.(Tribal Sub-Pkn) and 02 are C.D. blocks. The total population of district according to 2011 census is 5,77,817.

Analysis of Social Geography

Tribe- The word tribe in the Indian context conveys a meaning with dual characteristics, it refers to a state of tribalism which is ethnic as well as political (Schedules tribe) In Gajapati district about 54.29% of the population consists of Scheduled tribes Out of 62 scheduled tribes of Odisha three major communities namely Savara, ShabarLodha and Kondh live in Gajapati district As per 2011 census they constitute 98% of total tribal population of the district, the most dominant being Savares Savara constitute 47.47%, ShabaraLodhas 35.91% and Kondhs 14.12% of total tribal population of the

district There are many other numerically smaller tribes.

The saora, savar, saura, sahara have been clubbed together as one tribe The saora and saura are swidden cultivators, where assaharas are Hinduised tribe The savaras belong to Non-Aryan stock and are one of the most ancient tribes of India The saura villages are small with 20-30 houses They are known for their paintings They maintain a casteless society The household economy revolves round the women The saora religion is very elaborate and deep rooted They are polytheist and as a community known for their economic and political integrity.

The shabarLodha tribe claim their ancestry to Viswvasu and worship Lord Jagannath They practise clan exogamy Kondhs though the largest tribal group in Odisha form only 7.67% of Gajapati population They are believed to be from the Proto-Australoid ethnic group They have a subsistence economy based on shifting cultivation, hunting and gathering The common characteristic of all tribal groups is prevalence of bride price and importance of women in society.

Caste: Caste is a basic attribute of Indian Social structure. Social hierarchy is based on caste and it is this philosophical vision that determines the behavior of millions of Indian people in whichever walk of life they are. (Ahmed, 1999 p. 179). The prominent general castes in Gajapati are Brahmin, Gauda, Karan, Kshatriya, Kumuti, Reddy, Paik, etc. The SEBC and OBC castes are Badhei, Bhandari, Chitrakara, Dera, Gola, gudia, Kachara, Kansari, Kapu, Kumbhara, Luhura, Mali, Sundhi, Dunari and Teli. The SC population form 6.78% of the total population. It comprises mainly the castes of Bauri, BhoiChamar, Dom, Hadi, Jaggili, Kemta, Mala, Pana and Relli.

Table-1 : Population of different tribes of Gajapati district

Sl No	Name of Tribe	Total Population	Male	Female	% of tribal Population
1	Saora, Savara, Saura, Sahara	148927	72600	76327	47.97
2	ShabaraLodha	112648	54478	58170	35.91
3	Kondh, Khond	44306	21149	23157	14.12
4	Bhuiyan, Bhuyen	720	371	349	0.23
5	Jatapa	659	327	332	0.21
6	Kondadora	282	131	151	0.09
7	Koya, Gumbakoya	130	70	60	0.04
8	Matya, matia	152	70	82	0.05
9	Sounti	158	77	81	0.05
10	Tharua, Tarua, Bindhini	205	105	100	0.07
11	Others	5527	2524	3003	1.76

Source: District Gazetteer, Gajapati

Table-2 : Block wise distribution of SC & ST population in Gajapati -2011

Sl No	Name of Block	Total Population	% of SC population	% of ST population
1	Mohansa	133598	3.76	58.57
2	RUdayegiri	64123	2.38	69.49
3	Nuagada	54696	0.41	77.1
4	Guma	79520	3.47	75.87
5	Kushinagar	51414	15.59	35.78
6	Gosani	69447	1.54	15.73
7	Raygada	70866	2.55	80.89

Source – PCA, District Census Handbook, Gajapati, 2011

Language and Literacy

Language acts as a bridge in binding the diverse elements of a society. India is the home to a large number of languages. According to linguistic survey of India conducted by Sir George Abraham Griener towards the end of the 19th century there were 179 languages and as many as 544 dialects in the country. Gajapati presents a colourful confluence of people speaking multitude of languages. Although Odia is the dominant language Telugu has its own importance. Several tribal languages and Tibetan also find pride of place. The Saora or savara language belongs to kol-munda group of Austro-Asiatic family of languages. Their language is a kin to the kolarian stock which has close resemblance to the forms of speech of wild tribes of

Malyanpeninsula and Nicobar. The saora have developed their own script. The Kondhas use Kui language which is written in Odia script. The average literacy rate of Gajapati district is 53.49% and SC literacy rate is 47.98%, ST literacy rate is 42.99%. Lowest literacy rate of 32.08% is estimated for tribal women.

Religion

Religion is a moral philosophy, which plays an important role of promoting harmony, peace and commitment to civilized public behavior. Religion has acted as a civilizing force promoting humanism, respect for other forms of identity and a script of sacrifice in an endeavor to achieve higher goals for human co-existence. Gajapati district shows a

diversity of religious beliefs. According to 2011 census more than 61% of population are Hindus, 38% Christians, 0.38% Buddhist, 0.27% Muslim, 0.01% Jain, 0.01% Sikh and others. The Buddhist population is because of Tibetan population in Chandragiri.

Economy, Gender and Quality of life

Here we have tried to assess the economy and gender aspect by considering the work participation rate and percentage of main workers. The average work participation rate is 53.83% for the district as a whole with female work participation rate of 49.59%. Out of this about 57.56% of workers are main workers. Out of the female workers about 43.71% are engaged as main workers. Total female population in all the blocks exceed the total male population. This speaks a healthy social order and better gender relations; which may be due to higher percentage of tribal population. Quality of life may be defined as subjective well being. It is the degree to which a person enjoys the important possibilities of one's life. Which result from the opportunities and limitations available and reflect the interaction of personal and environmental factors. To measure quality of life we have taken some indicators, i.e no. of rooms in home, access to clean drinking water, toilet facility, waste water drinking facility and electricity. Only 9.8% of the total population has access to tap water from treated sources. About 4.57% of people have access to any type of toilet; there is no drainage connection for waste water

discharge in 75.49% houses. About 48.99% households are having electricity which is a somewhat bright spot in an otherwise gloomy scenario.

Conclusion

The social geography of Gajapati district presents a mini kaleidoscopic picture of India. Multitude of tribes, castes, languages, religions and customs blessed with a rich cultural heritage makes it a unique study for enthusiastic of social geography. This paper shows the tip of the iceberg, the vast multitude is still unexplored.

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Health and Nutritional Status of Rural Women in Varanasi District

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Dr Shweta

Abstract

The health of women is linked to their status in the society. The consumption of a wide variety of nutritious food is important for women's health. Adequate amounts of proteins, fats, carbohydrates, vitamins and minerals are required for a well balanced diet. Nutrition and food intake are closely related to nutritional status and health of an individual. Adequate amount of nutrients in the form of daily diet are essential for the maintenance of health and good nutrition (Negi et al., 1995). To get information about the nutritional food intake it was asked from women that how often they consume various types of food items (daily, weekly, occasionally and never). Women consume vegetables (both green leafy vegetables and other vegetables) most often. The majority of women (97.7%) consume green vegetables daily and only 2.3 per cent women consume it weekly. Pulses and beans are also important part of the diet for women. Almost 94.7 per cent women consume pulses or beans every day and 5.3 per cent eat weekly. Milk or curd is a common component of the diet for the majority of women, but 20.2 per cent consume it weekly, 9.5 per cent occasionally and 0.3 per cent respondents never consume milk or curd. Fruits are eaten every day by only 7.5 per cent women and 21.2 per cent women eat fruits at least once a week. Maximum 70.5 per cent respondents eat fruits occasionally. It is interesting to note that not a

single respondent consume eggs; and chicken, meat and fish daily, 14.8 per cent and 17.3 per cent respondents respectively never use such food items.

Keywords: Health, nutritional status, women health.

Introduction

The target of many health policies points to a need to focus on women's health. The health of women puts impact on the health of family and society, and so is critical for national development. "Women health involves emotional, social, cultural, spiritual and physical well beings: it is determined by the social, political and economic context as well as by biology" (Lauise, 2000). "A woman's health is her total well-being, not determined solely by biological factors and reproduction, but also by effects of work load, nutrition, stress, war and migration, among others" (Kwaak, 1991). The health of families and communities is tied to the health of women – the illness or death of a woman has serious and far-reaching consequences for the health of her children, family and community. The slogan, "Healthy Women, Healthy World" embodies the fact that as custodians of family health, women play a critical role in maintaining the health and well being of their communities (United Nations Population Division, 2005).

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The role of women in raising a healthy family and building society cannot be underestimated. Women provide the family's basic health needs, including obtaining potable water for the households, menu planning for the family's nutritional needs, and managing healthcare needs, such as environmental hygiene in the home and community. One could say that the health of the family and society is dependant to a large extent on the health of women (Kwapong, 2008). Women's poor health and nutritional status in India are inextricably bound with social, cultural and economic factors. These factors severely constrain the ability of women for acquiring good health services. Such conditions have consequences not only for the women themselves but also for the well-being of their children, the functioning of households and the distribution of resources. These include access to resources including health care, rural / urban residence, work status, caste and religion, poor quality of life, low literacy rate, marriage at young age, etc. Hence, there is an urgent, need to reorient population program priorities to focus on health needs and women based services.

Objectives

Keeping the above facts in mind the present paper aims at analyzing the health and Nutritional status of rural women across the various communities, age groups, education categories, family types and house types in Varanasi.

Material and Method

The information collected include caste, age, family type, education and house type wise knowledge about family planning methods, the methods adopted and sources of knowledge. The data were collected by primary field survey and analyzed using computer software and to know the health condition of women, body mass index (BMI) has also been calculated by weight and height of respondents.

Nutritional food intake by respondents

The consumption of a wide variety of nutritious food is important for women's health. Adequate amounts of proteins, fats, carbohydrates, vitamins and minerals are required for a well balanced diet. Meat, fish, egg and milk as well as pulses and nuts are rich in protein. Green leafy vegetables are rich sources of vitamin C. Bananas are rich in carbohydrates. Papayas, mangos and other yellow fruits contain carotene, which is converted to Vitamin A. Vitamin A is also present in milk products, as well as egg yolk (Gopalan et al., 1996). Nutrition and food intake are closely related to nutritional status and health of an individual. Adequate amount of nutrients in the form of daily diet are essential for the maintenance of health and good nutrition (Negi et al., 1995). To get information about the nutritional food intake it was asked from women that how often they consume various types of food items (daily, weekly, occasionally and never). Women consume vegetables (both green leafy vegetables and other vegetables) most often. The majority of women (97.7%) consume green vegetables daily and only 2.3 per cent women consume it weekly. Pulses and beans are also important part of the diet for women. Almost 94.7 per cent women consume pulses or beans every day and 5.3 per cent eat weekly. Milk or curd is a common component of the diet for the majority of women, but 20.2 per cent consume it weekly, 9.5 per cent occasionally and 0.3 per cent respondents never consume milk or curd. Fruits are eaten every day by only 7.5 per cent women and 21.2 per cent women eat fruits at least once a week. Maximum 70.5 per cent respondents eat fruits occasionally. It is interesting to note that not a single respondent consume eggs; and chicken, meat and fish daily, 14.8 per cent and 17.3 per cent respondents respectively never use such food items. Majority of the respondents use eggs, chicken, meat or fish occasionally (table 1) only.

Table-1: Nutritional food intake by women

Types of Food	Frequency of consumption				
	Daily	Weekly	Occasionally	Never	Total
Milk and Curd	70.0(280)	20.2(81)	9.5(38)	0.3(1)	400
Pulses and Beans	94.7(379)	5.3(21)	-	-	400
Green vegetables	97.7(391)	2.3(9)	-	-	400
Other vegetables	67.2(269)	31.3(125)	1.5(6)	-	400
Fruit	7.5(30)	21.2(85)	70.5(282)	0.8(3)	400
Eggs	-	7.7(31)	77.5(310)	14.8(59)	400
Chicken Meat, or Fish	-	7.5(30)	75.2(301)	17.3(69)	400

Source: Based on personal survey, 2016-17

Note: The figures given in parentheses indicate the number

Table-2: Caste/ communitywise nutritional food intake by women

Caste/ Community	Daily	Weekly	Occasionally	Never	Total no of respondents
General					
Milk and Curd	93.8(150)	5.6(9)	0.6(1)	-	160
Pulses and Beans	99.4(159)	0.6(1)	-	-	160
Green vegetables	99.4(159)	0.6(1)	-	-	160
Other vegetables	71.3(114)	28.1(45)	0.6(1)	-	160
Fruits	16.3(26)	26.3(42)	57.5(92)	-	160
Egg	-	4.4(7)	72.5(116)	23.1(37)	160
Chicken, meat or fish	-	0.6(1)	74.4(119)	25.0(40)	160
OBC					
Milk and Curd	65.4(89)	22.1(30)	12.5(17)	-	136
Pulses and Beans	95.6(130)	4.4(6)	-	-	136
Green vegetables	98.5(134)	1.5(2)	-	-	136
Other vegetables	61.0(83)	36.1(49)	2.9(4)	-	136
Fruits	1.5(2)	16.2(22)	81.6(111)	0.7(1)	136
Egg	-	2.2(3)	83.1(113)	14.7(20)	136
Chicken, meat or fish	-	1.4(2)	78.7(107)	19.9(27)	136
Muslim					
Milk and Curd	39.0(25)	46.9(30)	14.1(9)	-	64
Pulses and Beans	90.6(58)	9.4(6)	-	-	64
Green vegetables	98.4(63)	1.6(1)	-	-	64
Other vegetables	68.7(44)	31.3(20)	-	-	64
Fruits	-	29.7(19)	70.3(45)	-	64
Egg	-	32.8(21)	67.2(43)	-	64
Chicken, meat or fish	-	42.2(27)	57.8(37)	-	64
SC					
Milk and Curd	40.0 (16)	30.0(12)	27.5(11)	2.5(1)	40
Pulses and Beans	80.0(32)	20.0(8)	-	-	40
Green vegetables	87.5(35)	12.5(5)	-	-	40
Other vegetables	70.0(28)	27.5(11)	2.5(1)	-	40
Fruits	5.0(2)	5.0(2)	85.0(34)	5.0(2)	40
Egg	-	95.0(38)	5.0(2)	-	40
Chicken, meat or fish	-	-	95.0(38)	5.0(2)	40

Source: Based on personal survey, 2016-17

Note: The figures given in parentheses indicate the number

Table-2 points out substantial difference in nutritional food intake across the various communities. General community respondents have a better dietary intake than other communities. The most interesting fact of this survey is that only in Muslim community there is not a single woman who falls in a never consume category. Hindu women consume dairy products more often than Muslim women, whereas non-vegetarian food is consumed more often by Muslim respondents. If a comparison is made between SC and Muslim respondents, Muslim women record better dietary intake.

Table-3 reveals that age does not play major role in women's consumption pattern except that younger women whom dietary intake is slightly better than

older women. It is also remarkable that 27.5 per cent of above 30 years age group respondents never take chicken followed by 20-30 years respondents (10 per cent) and 15-19 years (4.8 per cent) respondents. Maximum numbers of all the age groups respondents take fruits, eggs and chicken occasionally.

Education is another vital indicator of the status of women. From this view point, education of women helps in taking better nutritional diet and also in making good decision to take better quality food for improving their health condition. There are substantial variations in educationwise food intake by respondents.

Table-3: Age groupwise nutritional food intake by women

Age Group	Daily	Weekly	Occasionally	Never	Total no of respondents
15-19 Year					
Milk and Curd	85.7(18)	14.3(3)	-	-	21
Pulses and Beans	90.5(19)	9.5(2)	-	-	21
Green vegetables	100.0(21)	-	-	-	21
Other vegetables	76.2(16)	23.8(5)	-	-	21
Fruits	4.8(1)	28.5(6)	66.7(14)	-	21
Egg	-	14.3(3)	80.9(17)	4.8(1)	21
Chicken, meat or fish	-	9.5(2)	85.7(18)	4.8(1)	21
20-30 Year					
Milk and Curd	65.7(132)	23.9(48)	10.4(21)	-	201
Pulses and Beans	94.5(190)	5.5(11)	-	-	201
Green vegetables	99.0(199)	1.0(2)	-	-	201
Other vegetables	67.2(135)	31.3(63)	1.5(3)	-	201
Fruits	8.0(16)	22.4(45)	69.6(140)	-	201
Egg	-	10.9(22)	80.6(162)	8.5(17)	201
Chicken, meat or fish	-	8.4(17)	81.6(164)	10.0(20)	201
Above 30 Year					
Milk and Curd	73.0(130)	16.9(30)	9.5(17)	0.6(1)	178
Pulses and Beans	95.5(170)	4.5(8)	-	-	178
Green vegetables	96.1(171)	3.9(7)	-	-	178
Other vegetables	66.3(118)	32.0(57)	1.7(3)	-	178
Fruits	7.3(13)	19.1(34)	71.9(128)	1.7(3)	178
Egg	-	3.4(6)	73.6(131)	23.0(41)	178
Chicken, meat or fish	-	5.6(10)	66.9(119)	27.5(49)	178

Source: Based on personal survey, 2016-17

Note: The figures given in parentheses indicate the number

Table-4: Educationwise nutritional food intake by women

Educational level	Daily	Weekly	Occasionally	Never	Total no of respondents
Illiterate					
Milk and Curd	45.1(60)	32.3(43)	21.8(29)	0.8(1)	133
Pulses and Beans	92.5(123)	7.5(10)	-	-	133
Green vegetables	95.5(127)	4.5(6)	-	-	133
Other vegetables	54.1(72)	43.6(58)	2.3(3)	-	133
Fruits	2.3(3)	15.7(21)	79.7(106)	2.3(3)	133
Egg	-	5.3(7)	77.4(103)	17.3(23)	133
Chicken, meat or fish	-	6.8(9)	75.2(100)	18.0(24)	133
Primary					
Milk and Curd	76.9(90)	19.7(23)	3.4(4)	-	117
Pulses and Beans	95.7(112)	4.3(5)	-	-	117
Green vegetables	98.3(115)	1.7(2)	-	-	117
Other vegetables	69.2(81)	29.9(35)	0.9(1)	-	117
Fruits	7.7(9)	17.1(20)	75.2(88)	-	117
Egg	-	7.7(9)	80.3(94)	12.0(14)	117
Chicken, meat or fish	-	11.1(13)	72.7(85)	16.2(19)	117
High school					
Milk and Curd	80.8(59)	12.3(9)	6.9(5)	-	73
Pulses and Beans	91.8(67)	8.2(6)	-	-	73
Green vegetables	98.6(72)	1.4(1)	-	-	73
Other vegetables	68.5(50)	30.1(22)	1.4(1)	-	73
Fruits	8.2(6)	19.2(14)	72.6(53)	-	73
Egg	-	2.7(2)	86.3(63)	11.0(8)	73
Chicken, meat or fish	-	4.1(3)	82.2(60)	13.7(10)	73
Above high school					
Milk and Curd	92.2(71)	7.8(6)	-	-	77
Pulses and Beans	100.0(77)	-	-	-	77
Green vegetables	100.0(77)	-	-	-	77
Other vegetables	85.7(66)	13.0(10)	1.3(1)	-	77
Fruits	15.6(12)	39.0(30)	45.4(35)	-	77
Egg	-	16.9(13)	64.9(50)	18.2(14)	77
Chicken, meat or fish	-	6.5(5)	72.7(56)	20.8(16)	77

Source: Based on personal survey, 2016-17

Note: The figures given in parentheses indicate the number

Illiterate women have poor and less varied diet than literate women and their diets are particularly deficient in nutritious foods such as milk or curd, fruits, eggs and chicken, meat or fish. Table 4 shows that 45.1 per cent illiterate women consume milk or curd daily, 32.3 per cent take it weekly, 21.8 per cent occasionally and 0.8 per cent women respondents never consume milk or curd in their diet

followed by primary educated respondents where such percentages are 76.9 per cent, 19.7 per cent and 3.4 per cent respectively. In high school 80.8 per cent respondents take daily, 12.3 per cent weekly and 6.9 per cent occasionally. The same condition is also found in above high school for taking dairy products. It is remarkable to pin point that not a single literate respondent is found intake

category in terms of dairy products. It is found only in illiterate categories. All the categories of respondents consume pulses, green vegetables and other vegetables in almost equal proportion.

Analysis of body mass index (BMI)

This index is defined as the weight in kilograms divided by the height in meters squared (Kg / m^2). The body mass index is used to assess both thinness and obesity. It is a calculation to determine the amount of fat in ones body, and therefore their being at risk of weight related diseases such as diabetes. The body mass index was devised in 1840 by Adolphe Quelet, a Belgian scientist, and has since been adopted worldwide as the standard way to measure obesity. BMI less than 18.5 indicates to the chronic nutritional deficiency. Similarly, index 23.5 – 28.5 refers to overweight and obesity oriented. The BMI value above 28.8 refers to obese condition. This BMI index adopted for NFHS-2 survey has been chosen as the base for the present study. World Health Organization (WHO) referred this index as 18.7 – 23.8 for healthy weight. Similarly, the U.S. Health and Human Services Department adopts index 18.5 to 25.0 as healthy weight and 25- 29.9 as overweight and above 30 as obesity. In the well-nourished society desirable range may be little higher. The mean BMI in the study area is 21.1 which is slightly higher than the State's mean ($20 \text{ kg} / \text{m}^2$). More than one among five women in the area under study has BMI below 18.5 indicating a high prevalence of nutritional deficiency.

This index ranges from 14.80 to 29.29 for all groups. Table 5 pinpoints that 21 and 35 per cent woman respondents are below and above desirable weight range respectively. Both ranges alarm the policy makers for due attention. In the study area only 44 per cent women are found within the normal range of 18.5 to 23.5. Indeed, BMI is the reflection of several factors such as the standard of living, income, education, occupation, family type, community, age group and land ownership. Hence it

is imperative to correlate BMI with these causative factors.

Table-5: Body mass indexwise women's respondents

BMI range	Percentage of women respondents
Less than desirable weight for height (<185)	21
Normal than desirable weight for height (185-235)	44
More than desirable weight for height (> 235)	35

Source: Based on personal survey, 2016-17

Occupation and BMI

The occupation plays a vital role in ascertaining the BMI. In the study area about 70 per cent women are housewives and remaining 30 per cent are distributed in three occupational categories i.e. service class, household industrial worker and labourer. Only labour class women can be distinguished with poor health having mean BMI of 19.2. This fact becomes obvious when we observe the proportion of women (60.0 %) falling below healthy weight range. Service class women have 3 mean BMI higher than labour class. But an unfortunate fact of this study is that the one – third of service class women also fall below the normal range. This makes the inference debatable. From almost all view points, housewives reveal healthier position.

Table-6: Occupationwise mean BMI for women

Occupation	Percentage of respondents to total	Mean BMI	% of respondents below 185 BMI
Service	09	22.9	33.3
House wife	70	22.7	12.8
House hold industry	11	21.3	27.2
Labourer	10	19.2	60.0

Source: Based on personal survey, 2016-17

Body Mass Index (BMI) and Income Relation

BMI directly relates to the standard of living or income. In the area under study about 31 per cent women possessing family income above Rs. 5000-0 per month reveal the highest mean BMI (23.4). The mean BMI is decreasing with reducing monthly income. About 18 per cent women having monthly income below Rs 1000-0 are characterized by the lowest mean BMI of 20.3. Simple description of income and mean BMI does not present the true picture without looking at the range analysis. This analysis seems quite appealing because about 50 per cent women of the lowest income group are at risk and the proportion is declining towards higher income group. Thus income and BMI have direct positive correlation.

Table-7: *Incomewise mean height for women*

Monthly income in Rs	Percentage of respondents to total	Mean BMI	% of respondents below 185 BMI
< 1000	18	20.3	50.00
1000-3000	31	22.2	19.35
3000-5000	20	22.5	25.50
> 5000	31	23.4	3.25

Source: *Based on personal survey, 2016-17*

Conclusion

Health is one of the important components in the socio- economic development. The promotion and protection of health of the people is essential for sustained economic and social development; and for achieving a better quality of life and world peace. The consumption of a wide variety of nutritious food is essential for good women's health. The analysis evinces that those who are economically good get better nutritional intake than that of poor counterparts. Thus, the analysis confirms that the socio- economic status of the respondents is closely associated with the nutritional status. The body mass index is used to assess both thinness and obesity. It is a calculation to determine the amount of fat in

one's body. The mean BMI in the study area accounts for 21.1 which is slightly higher than the State's mean (20 kg / m²). More than one among five women in the area under study has BMI below 18.5 indicating a high prevalence of nutritional deficiency. This index ranges from 14.80 to 29.29 for all groups. About 21 and 35 per cent women respondents are below and above desirable weight range respectively. The health of women puts substantial impact on health of the family and society, and so it is critical for national development. Both ranges alarm to the policy makers for due attention.

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Measuring the Land Surface Temperature (LST) Variation in Cuttack City, Odisha Using Landsat Data

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Abstract

The study has intended to determine the relationship between Urbanization, Land Use Land Cover (LULC) change and Land Surface Temperature (LST) during the period 1999 to 2019 in Cuttack city. The acquired Landsat 5 TM⁺ & 8 OLI remotely sensed data are used to obtain all the concluding results. The study is revealed a relationship between urbanization and LST through image analysis on LULC change and their respective LST value over a period of 20 years. The remote sensing & GIS technique; maximum likelihood supervised classification method has been used to determine all the LULC types and their spatio-temporal change analysis. It was found that the city has changed their LULC considerably leading with Built-up areas i.e. increased 33.14 per cent (1999) to 58.4 per cent (2020). Further analysis on LST has found that, the high value of surface temperature associated with Bare Land and Built-Up areas. In order to establish a significant relationship between LULC type and LST, different land use indices as Normalized Difference Vegetation Index (NDVI) & Normalized Difference Built-up Index (NDBI) were obtained and correlated to LST. A negative correlation has been found between NDVI with LST whereas NDBI shown a positive correlation with LST. Availability of less vegetation cover and less moisture content is the possible reason in formation of such condition in this land use category.

Key words: *Urbanization, LULC, LST*

Introduction

In the current scenario, accelerated urbanization and industrialization results high rate of migration from rural to urban area, as a result of which the rate of loads on natural resources consequently increasing. High rate of urbanization marks as a burden on cities and lead the way to numerous changes in environment, natural landscape, biodiversity and ecosystems (Bahi et al., 2016). The man-made built-up concrete structures have a different land surface characteristics from natural environment. Different surface albedo, emissivity and thermal properties of land surface are the major driving factors responsible for controlling the LST and energy balances. Rapid urbanization and transformation of vegetated, agricultural lands and marshland into built-up areas is a significance LULC change responsible for rise of LST in cities (Lilly Rose, 2009; Mishra and Rai, 2016; Tran et al., 2017). The alteration of natural land surface into artificial land surface forms a distinguished localized urban climate. Differential climatic characteristics found in urban areas which differ from surrounding rural areas. The distinct dissimilarities in temperature as an urban area has higher temperature than adjoining area referred to as urban heat island (UHI)

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(Landsberg 1981; Oke 1987). Hence Urban Heat Island (UHI) is a phenomenon in which an urban area is warmer than its surrounding suburban and rural areas (Sundborg 1951). In general, the configuration of urban areas such as building concentration, building tallness, materials of building, size and shapes etc. are the controlling factors in order to control the LST.

Study Area

In this study Cuttack City selected as the field of enquiry situated in the eastern part of Indian subcontinent. It is one of the eldest and populated city of Odisha situated at the branching of the river Mahanadi and its distributary river Kathajodi with

an area of about 50 sq. k.ms. Geographically the city lies at 20° 31' 25" N latitude 85° 47' 17" E longitude with an elevation of 36 meters. The city has a tropical savanna Aw (winter dry) type of climate according to Koppen's climatic classification. The summer is remain hot and humid. In monsoon months the city receives most of its rainfall. The most ideal climate is experienced between middle of January to the middle of March, with temperatures ranging a minimum of 22.2 °C and a maximum of 33.4 °C. According to the Census of India demographically the city has a population of 6.06 lakh in 2011. Figure 1 represents the location map for the study area.

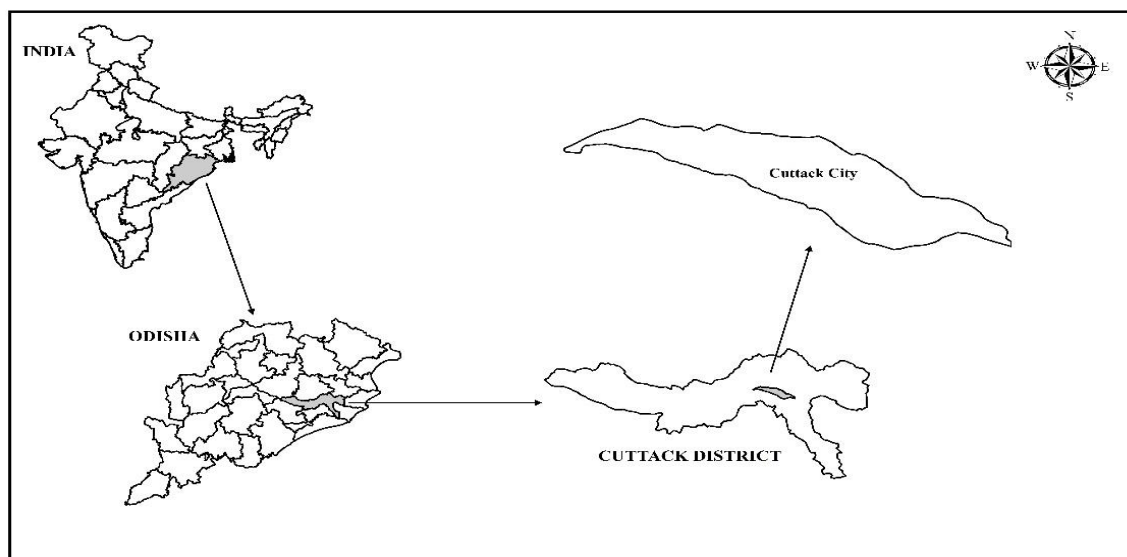


Fig. 1: Location map of Cuttack City, Odisha

Objectives

This study aims to estimate the LST and to analyse its relationship with LULC using GIS and Remote Sensing techniques with Landsat imagery. The key objectives of this study are;

1. To analyse the spatio-temporal change in LULC in the study area.
2. To estimate the spatio-temporal change in LST.

3. To assess the existing correlation between LST and LULC.

Database and Methodology

Data description

The prime source of data for this study are based upon secondary sources. The source of spatial data satellite imagery were collected to analyze the

LULC, LST and other related spatial analysis. Landsat 5 Thematic Mapper (TM) data for May 1999 and Landsat 8 OLI May 2009, April 2019 have acquired from the US Geological Survey (USGS) with Path/Raw of 140/46. The Landsat TM data resolution lies between 30 m to 120 m (Table 1), while Landsat 8 OLI data resolution lies between 15 m to 100 m (Table 2).

Table-1: Landsat-5 (TM) Band Characteristics and Resolution

Landsat-5 Thematic Mapper			
Band	Band Information	Wavelength	Resolution
Band 1	Visible Blue	0.45 to 0.52 μm	30 meter
Band 2	Visible Green	0.52 to 0.60 μm	30 meter
Band 3	Visible Red	0.63 to 0.69 μm	30 meter
Band 4	Near-Infrared	0.77 to 0.90 μm	30 meter
Band 5	Short-Wave Infrared	1.55 to 1.75 μm	30 meter
Band 6	Thermal	10.40 to 12.50 μm	120 meter
Band 7	Short-Wave Infrared	2.09 to 2.35 μm	30 meter

Source: USGS Landsat Users Handbook

Table-2: Landsat-8 (OLI & TIRS) Band Characteristics and Resolution

Landsat-8 Operational Land Imager (OLI) & Thermal Infrared Sensor (TIRS)			
Band	Band Information	Wavelength	Resolution
Band 1	Coastal/Aerosol	0.43 to 0.45 μm	30 meter
Band 2	Visible Blue	0.45 to 0.51 μm	30 meter
Band 3	Visible Green	0.53 to 0.59 μm	30 meter
Band 4	Visible Red	0.64 to 0.67 μm	30 meter
Band 5	Near-Infrared	0.85 to 0.88 μm	30 meter
Band 6	Short Wavelength Infrared	1.57 to 1.65 μm	30 meter
Band 7	Short Wavelength Infrared	2.11 to 2.29 μm	60 meter
Band 8	Panchromatic	0.50 to 0.68 μm	15 meter
Band 9	Cirrus	1.36 to 1.38 μm	30 meter
Band 10	Long Wavelength Infrared (TIRS-1)	10.60 to 11.19 μm	100 meter
Band 11	Long Wavelength Infrared (TIRS-2)	11.50 to 12.51 μm	100 meter

Source: USGS Landsat 8 Data Users Handbook

Methodology

Arc GIS v.10.3 software used to estimate the classification and mapping of LULC, LST, Land use indices and other spatial analysis in the study area. Along with this tools, Microsoft excel is also used for data analysis and preparation of statistics.

Land Use Land Cover (LULC) Classification Method and Change detection

The most common image analysis for extracting LULC is digital image classification. There are two broad types of classification procedure. One is referred to as supervised classification and the other one is unsupervised classification. The maximum likelihood supervised classification technique used for classifying various multispectral images which are based on traditional pixel based method which has been played a great importance for classifying low resolution images. In this study the collected Landsat satellite images were processed in Arc GIS v.10.3 and classified into four broad LULC classes (Water Body, Vegetation, Built-up Area, and Bare Land) for the year of 1999, 2009 and 2019 based on the Maximum Likelihood Supervised Classification technique. In order to produce LULC change detection maps of the study area several samples were collected. The change detected were in the form of area in sq. k.ms. and percentage.

Estimation of Land Surface Temperature (LST)

Landsat thermal bands were used to derive the LST for the year 1999, 2009 and 2019. Landsat sensor collect and store thermal data as digital numbers (DN's). This study followed a three-step process to convert available DN's into LST for Landsat 5 TM, and a seven steps process for Landsat 8 OLI images.

The following steps were followed to estimate LST using LANDSAT 5 TM+ imagery;

Step 1: In the first step the following equation was used to convert DN's of Band 6 into radiance units.

$$L_{\lambda} = \left[\frac{L_{max\lambda} - L_{min\lambda}}{Q_{CALmax} - Q_{CALmin}} \right] * (Q_{CAL} - Q_{CALmin}) + L_{min\lambda}$$

Where; L_{λ} = Spectral Radiance at the sensor's aperture in [watts / (meter² * ster * μ m)]

Q_{CAL} = the quantized calibrated pixel value in DN

$L_{min\lambda}$ = the spectral radiance that is scaled to Q_{CALmin} in watts / (meter² * ster * μ m)

$L_{max\lambda}$ = the spectral radiance that is scaled to Q_{CALmax} in watts / (meter² * ster * μ m)

Q_{CALmin} = the minimum quantized calibrated pixel value (corresponding to $L_{min\lambda}$) in DN

Q_{CALmax} = the maximum quantized calibrated pixel value (corresponding to $L_{max\lambda}$) in DN

Step 2: In step two the following equation was used to derive LST in Kelvin.

$$T_K = \frac{K2}{\ln\left(\frac{K1}{L_{\lambda}} + 1\right)}$$

Where; T_K = Temperature in Kelvin

$K2$ = Calibration constant 2 = 1260.56 in [watts / (meter² * ster * μ m)]

$K1$ = Calibration constant 1 = 607.76 in [watts / (meter² * ster * μ m)]

L_{λ} = Spectral radiance in [watts / (meter² * ster * μ m)]

Step 3: After getting LST value in Kelvin, it was converted into Degree Celsius ($^{\circ}$ C).

$$T_C = T_K - 273.15$$

Where; T_C = Temperature in Degree Celsius ($^{\circ}$ C).

The following steps were followed to estimate LST using LANDSAT 8 OLI Satellite Imagery;

Step 1: In this step the following equation was used to convert DN's of both the thermal infrared sensor (TIRS) Band 10 and Band 11 into spectral radiance.

$$L_{\lambda} = ML * Q_{cal} + AL$$

Where; L_λ = Spectral radiance in [watts / (meter² * ster * μ m)]

ML = Radiance multiplicative scaling factor for the band

(RADIANCE_MULT_BAND_n from the metadata)

AL = Radiance additive scaling factor for the band

(RADIANCE_ADD_BAND_n from the metadata)

Qcal = the quantized calibrated pixel value in DN

Step 2: Using the band specific thermal constants given in the metadata file, the spectral radiance (L_λ) has converted to Top of atmosphere brightness temperature (T).

$$T = \frac{K2}{\ln\left(\frac{K1}{L_\lambda} + 1\right)} - 273.15$$

Where; T = Top of atmosphere brightness temperature in (°C).

K1 = Band specific thermal conversion constant from the metadata

(K1_CONSTANT_BAND_x, where x is the thermal band number)

K2 = Band specific thermal conversion constant from the metadata

(K2_CONSTANT_BAND_x, where x is the thermal band number)

L_λ = Spectral radiance in [watts / (meter² * ster * μ m)]

Step 3: In the third step following equation was used to calculate NDVI.

$$NDVI = \frac{[NIR (BAND 5) - RED (BAND 4)]}{[NIR (BAND 5) + RED (BAND 4)]}$$

Where the value lies between $-1 < NDVI < +1$.

Step 4: At this step the minimum and maximum value of NDVI was used to calculate Proportion of Vegetation (P_V).

$$P_V = \left(\frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}\right)^2$$

Step 5: After getting Proportion of Vegetation, the Land Surface Emissivity (LSE) was calculated by the following equation.

$$LSE = 0.004 \times P_V + 0.986$$

Step 6: In this step LST was calculated for both Band 10 and 11 by using the following equation.

$$LST = \frac{T}{\left\{1 + \left[\frac{\lambda T}{\rho}\right] \ln(LSE)\right\}}$$

Where; T = Top of atmosphere brightness temperature in (°C)

λ = the wavelength of emitted radiance

ρ (Constant) = 14380

Step 7: A mean average of LST for Band 10 and Band 11 was obtained through cell statistics feature in ArcGIS v.10.3.

Results and Discussion

Land Use and Land Cover (LULC) Change Analysis

The maximum likelihood supervised classification method has used to identify all the four LULC types. It was found both positive and negative changes has been taken place in LULC during the study period. Figure 2 illustrates the LULC map of Cuttack City for the year 1999, 2009 and 2019 & Table 3 depicts the distribution of area and it's percentage of different LULC in Cuttack city. It has found that in the year 1999, area under Built-up area was 15.445 km², which raised to 19.853 km² in

2009 and in 2019 it was further raised to 27.219 km². Here it indicates about the expansion of the city and rapid urbanization happened over two decades. In case of vegetation cover it was a negative growth found between the year 1999 and 2019 by its covered area. In 1999 about 15.801 km² of area covered by vegetation which was more than built-up area, in 2009 it has reduced to 12.681 km² and again reduced to 10.845 km². The water bodies comprises areas of surface water either impounded

in the form of lake and reservoirs or flowing streams, river, canals etc. There are few canals and swage canals flowing through Cuttack city. The area under water bodies is estimated about 3.1626 km² in 1999, which reduced to 1.2231 km² in 2009 and it was 0.9882 km² in 2019. The total area covered under bare land has raised from 12.202 km² to 12.855 km² during the period 1999 to 2009, which declined to 7.56 km² in the year 2019.

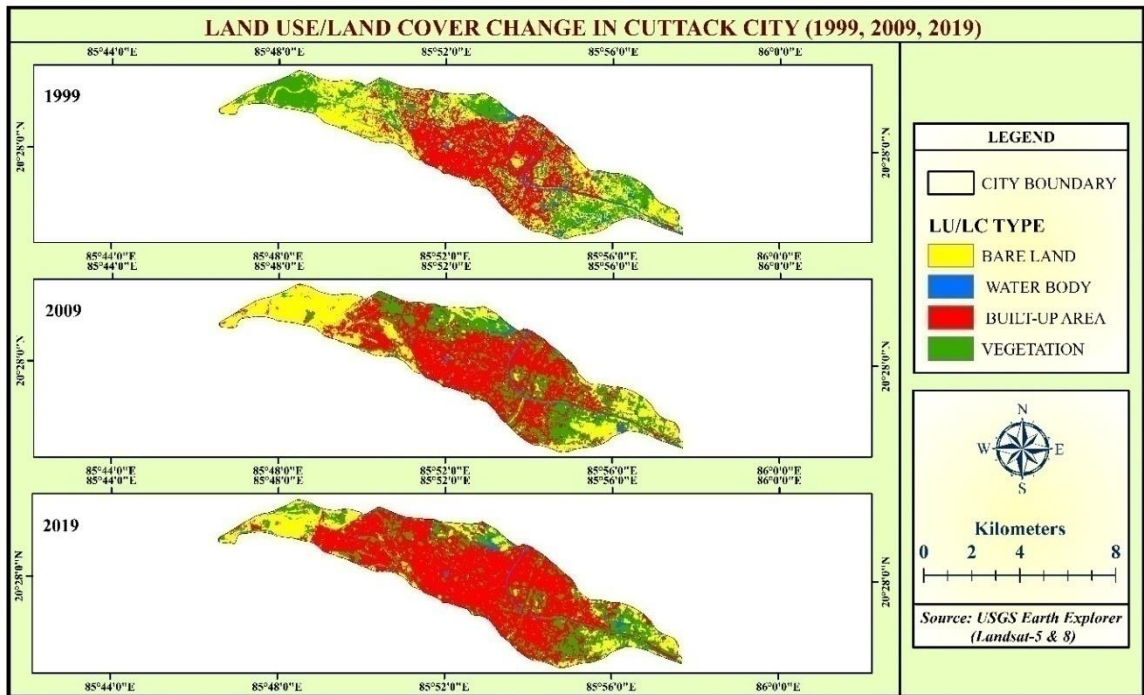


Fig. 2: Land Use and Land Cover map of Cuttack City for the year 1999, 2009 and 2019

Table-3: Distribution of area with different LULC in Cuttack city

LULC Type	Area in Km ²			Area in Percentage (%)		
	1999	2009	2019	1999	2009	2019
Water Body	3.1626	1.2231	0.9882	06.785	02.62	02.12
Vegetation	15.8017	12.681	10.845	33.90	27.20	23.27
Built-Up Area	15.4458	19.8531	27.2196	33.14	42.59	58.40
Bare Land	12.2027	12.8556	7.56	26.18	27.58	16.22
Total Area	46.6128	46.6128	46.6128	100	100	100

Obtained from the Landsat image analysis

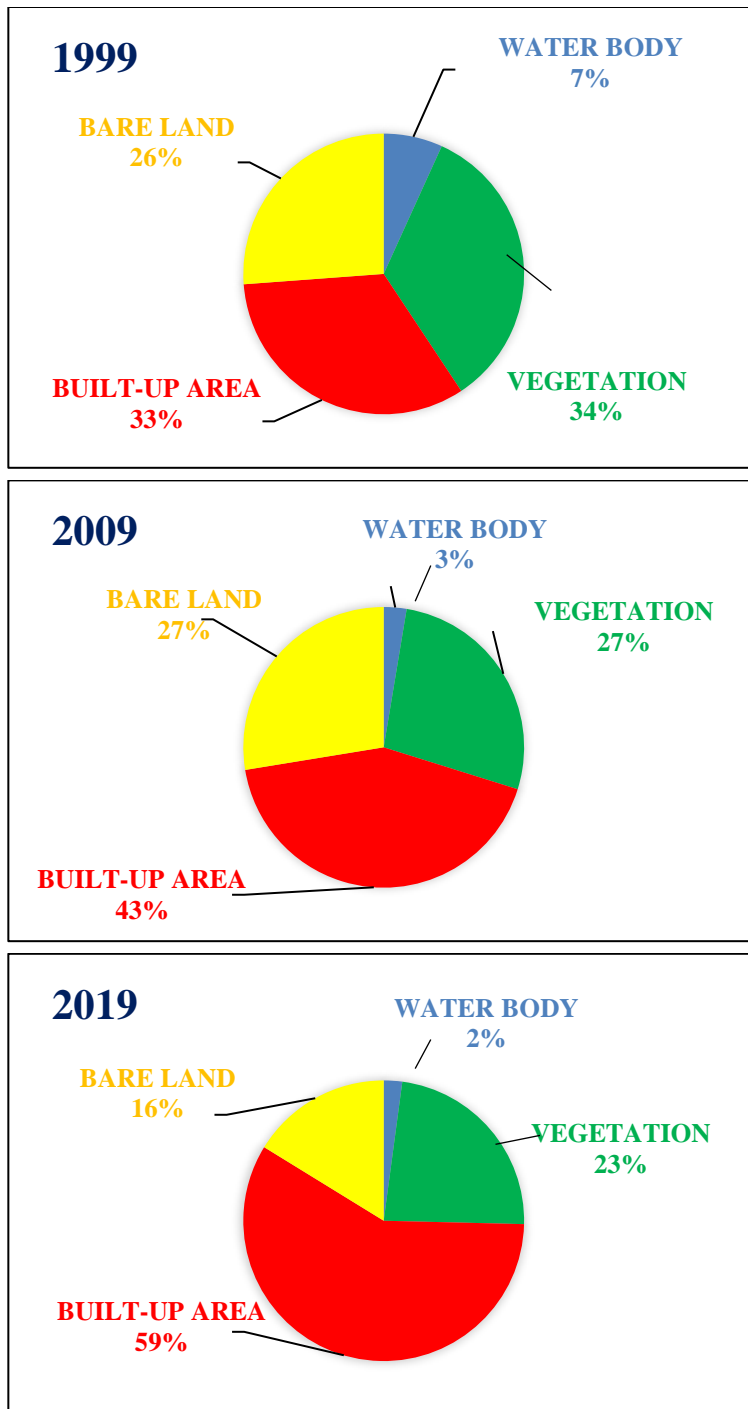


Fig. 3: Showing the Pie diagram of Percentage (%) wise distribution of different LULC in Cuttack City for the year 1999, 2009 & 2019

Figure 3 represents pie diagram with percentage wise distribution of different LULC in Cuttack City for the year 1999, 2009 & 2019. The built-up area increased from 33.4 percent in 1999 to 42.59 percent in 2019. Whereas in case of vegetation in 1999 it was about 33.9 percent, in 2009 reduced to 27.2 percent and in 2019 again it has reduced to 23.27 percent. From the result it is found that some portion of bare land and vegetation cover converted into built-up area.

Change Analysis on Land Surface Temperature (LST)

In this section the study has analysed the changing pattern of LST in Cuttack city for the year 1999 to 2019. Fig. 4 showing map for the spatio-temporal change pattern of LST in Cuttack city. The

schematic variation also reflected an idea about changing pattern of LST across the study area. The variation of LST has identified with distinct colors, where the low temperature region represented with bluish color whereas the region with high temperature is identified with deep brown color. The map for Cuttack city (Fig. 4) represents that in 1999 the highest value of LST recorded about 30.18°C whereas the lowest LST value was 21.61°C. In the year 2009 the LST range is raised to 40.54°C & further in the year 2019 the LST further raised its value i.e. ranging from 41.88°C to 29.87°C. From the observation it is evidently found that the changing spatio-temporal variation of LST highlights the rapid modification of LULC change in the study area.

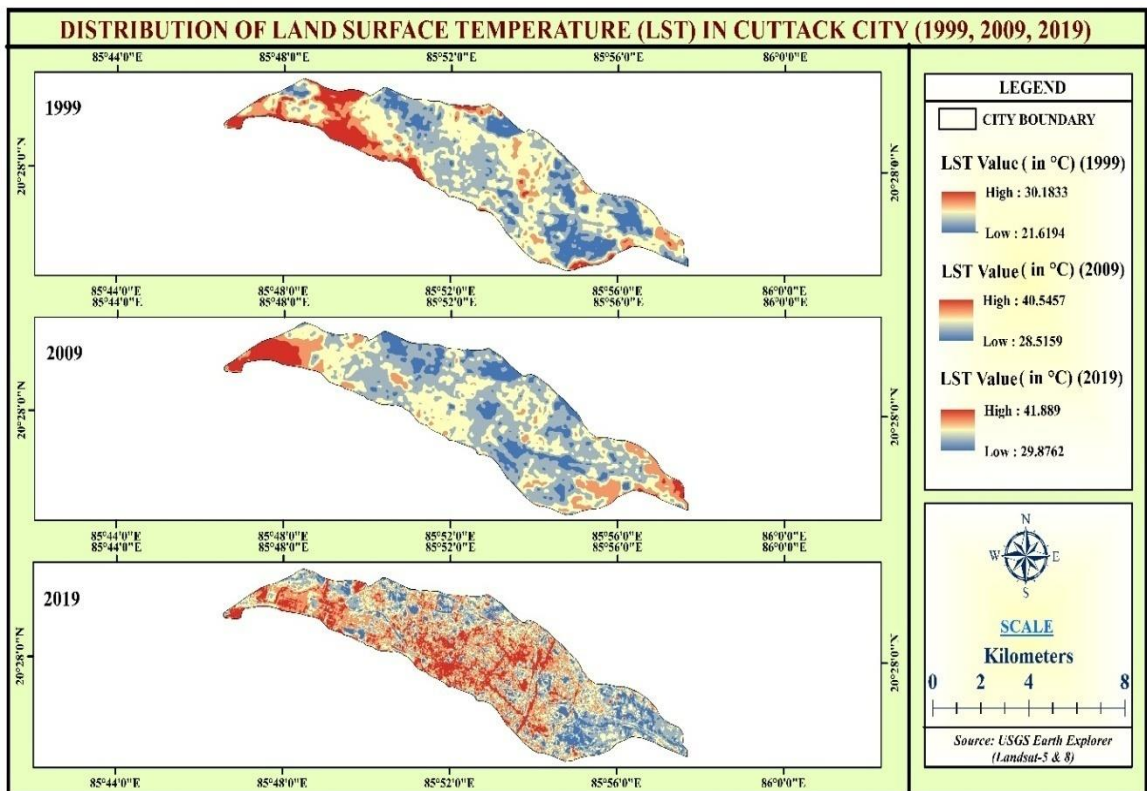


Fig. 4: Distribution of LST in Cuttack City for the year 1999, 2009 & 2019

Association of Land Surface Temperature over Land Use and Land Cover Types

The distribution of LST over different LULC types were calculated and represented in Table 4 for Cuttack City. To discover LST profile based on different LULC, zonal statistics analysis were made

for the year 1999, 2009 and 2019 using Arc GIS v10.3. From the overall analysis it was found that Bare Land represents highest surface temperature followed by Built-up area. The lowest surface temperature detected over water bodies, which is followed by vegetation cover.

Table-4: Relationship between Land Surface Temperature and Land Use Land Cover type

LULC Type	Year	1999	2009	2019
Water Body	Min. Temp. (°C)	21.62	28.52	31.24
	Max. Temp. (°C)	27.25	35.06	37.68
Vegetation	Min. Temp. (°C)	22.06	28.93	29.87
	Max. Temp. (°C)	28.93	36.22	35.72
Built-up Area	Min. Temp. (°C)	22.94	30.60	32.50
	Max. Temp. (°C)	29.35	40.39	41.89
Bare Land	Min. Temp. (°C)	22.50	30.18	37.82
	Max. Temp. (°C)	30.18	40.55	41.77

Zone statistics outcome of LST for different LUtypes for all the three years is shown in Table 6.2. In the year 1999 and 2009 Bare Land represents highest surface temperature i.e. 30.18°C in 1999 & 40.55°C in 2009, whereas in year 2019 the highest temperature was observed in Built-up area 41.77 °C. The lowest surface temperature was observed in water bodies in the year 1999 and 2009 i.e. 21.62°C in 1999 and 28.52°C in 2009. In year 2019 the lowest value of surface temperature recorded in vegetation cover 29.87°C, followed by water body 31.24°C.

Correlation between Land Surface Temperature and Land Use Indices (NDVI & NDBI)

To find out a significant relationship between LST and LULC, Normalized Difference Vegetation Index (NDVI) and Normalized Difference Built-up Index (NDBI) were derived. It has seen that the NDVI in Cuttack city decreased over the year i.e. in 1999 the range of NDVI was -0.294 to 0.559, in 2009 it was declined to -0.184 to 0.551 and in 2019 the range is further decreased to -0.047 to 0.545 (Fig. 5). Contrary to NDVI, NDBI has increased over the time scale. In 1999 it was ranging from -2282 to 0.2503. It increased to -0.2933 to 0.2677 in 2009 and in 2019 further raised to -0.3166 to 0.2761 (Fig. 6).

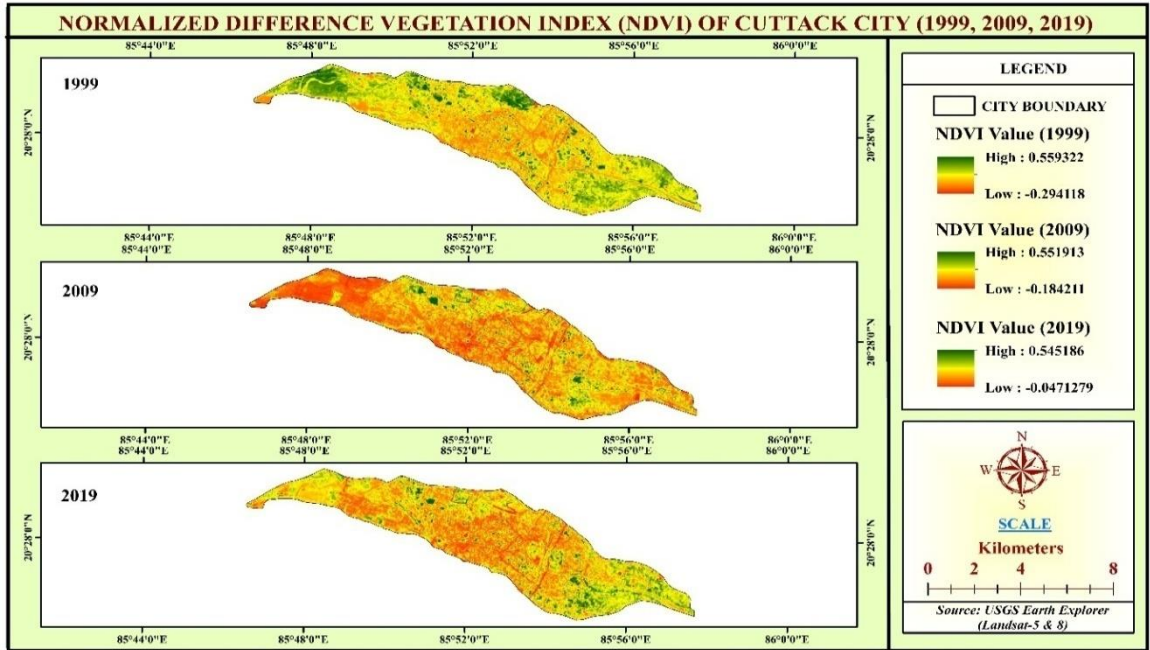


Fig. 5: NDVI map of Cuttack City for the year 1999, 2009 & 2019

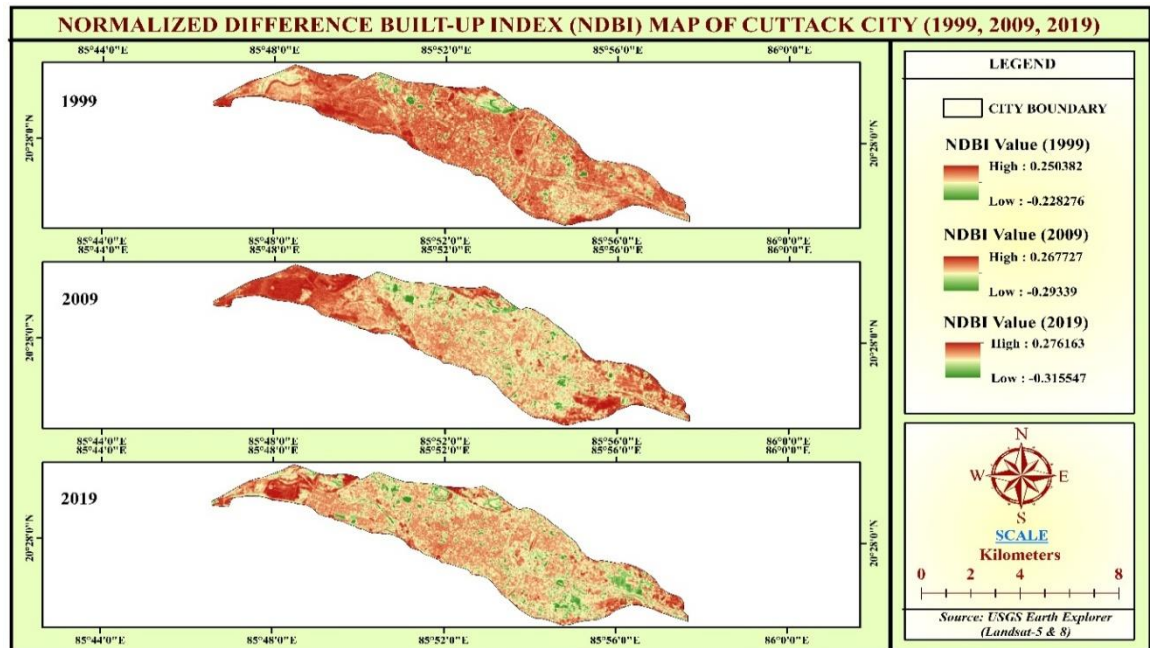
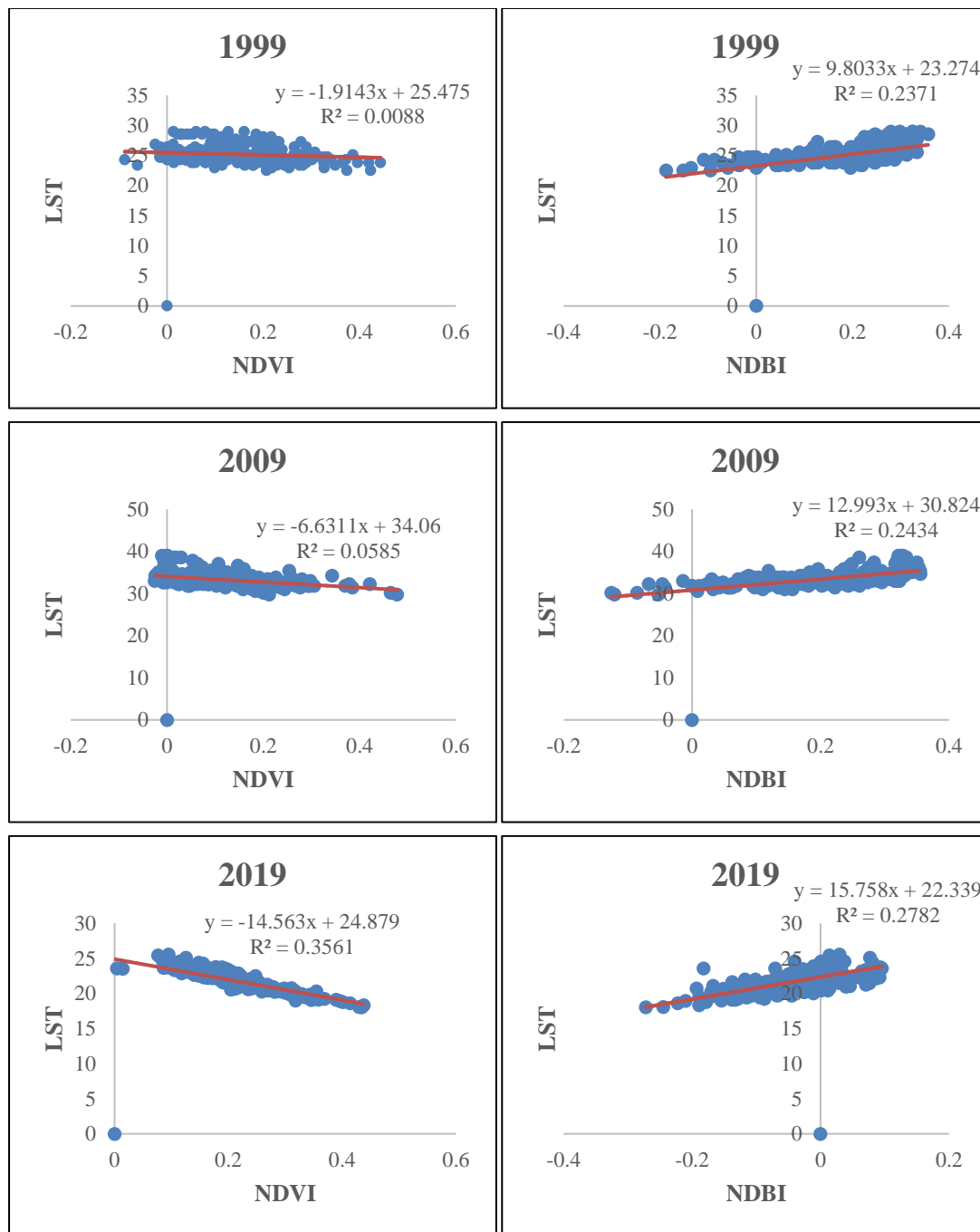


Fig.6: NDBI map of Cuttack City for the year 1999, 2009 & 2019



(a)

(b)

Fig. 7: Correlation between LST and NDVI(b) Correlation between LST and NDBI

Scatter diagram has represented in fig.7 (a) & (b) which shows the correlation between LST vs. NDVI & LST vs. NDBI respectively. It was concluded that a positive relationship exist between the LST and NDVI whereas a negative relationship exist between LST and NDBI. Availability of dense vegetation/trees and occurrence of evapotranspiration leads to creation of low temperature while contrary to that high built-up and bare land leads to form high temperature.

Conclusion

The study has envisioned to evaluate LULC and LST change during the period 1999 to 2019 in Cuttack City. On the basis of results and outcome, following are the key conclusions of the study.

The total Built-Up area increased in the city i.e. 33.14% (1999) to 58.4% (2019). The built-up area of Cuttack city has grown more rapidly than other LULC types. The increased size in Built-Up area leads to a decrease in Vegetation cover and Water Bodies. It is found that major portion of Bare Land is converted into urban built-up area with city expansion.

The study has found that high value of surface temperature associates with Bare Land and Built-Up areas. The possible reason for this situation is less moisture and availability of less vegetation cover in this land use category.

It revealed that Cuttack City an Old city which developed in an unplanned manner with cluster settlement, where high building density and lack of vegetation cover leads to affect our environment.

The above findings concluded that if such trends of growth continues, the Built-up area along with LST will also be continued to increase in the coming future, which will results several economic, environmental problems for the cities.

To mitigate these issues Govt. authorities can be create policies, strategies, awareness programs, rules

and regulations which helpsto creation of awareness among peoples. Along with developments different sustainable measures can be adopted by creating natural environments like roof top plantation, plantation in bare areas, roadside plantation and usage of high albedo materials which are low heat absorbing in nature.

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Out-Migration Processes the Houselessness in Metropolitan Cities: A Case for Kanpur City

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Abstract

The present research work attempts to analyse the settlement and migratory status of houseless population, and reasons of out-migration operating at their places of origin. The study is based on primary source of data generated through a comprehensive field survey in the city carried out during 2012. The study reveals that more than seventy percent houseless people have their places of origin in the rural areas of the country and more than ninety percent houseless persons are recorded as migrants in the city. Moreover, the economic reasons, by far, predominate among the pushing factors of houseless out-migration from the places of origin in comparison to social, morbidity and natural calamities.

Keywords: Houseless Population, Migration, Pushing Factors, Places of Origin, Kanpur City.

Introduction

Migrations on the surface of the Earth have occurred throughout human history, beginning with the movements of the first human groups from their places of origin in East Africa to their present settlements in the world. Human migration basically is the movement of people from one place to another for the purpose of taking up permanent or semi-permanent residence as defined by migration defining boundary as well as migration defining period. People move for a variety of reasons from one place to another over period of time by

considering the advantages and disadvantages of staying versus moving, as well as factors such as distance, travel costs, travel time, modes of transportation, terrain, and cultural barriers, etc. Migration is often considered as a driver of growth and socio-economic development by route out of poverty with significant positive impact on people's livelihoods and well-being (Anh, 2003:27-40 and Mejia & Pizurki 1976: 455-460). As, there is a general opinion that migration and remittances reduce poverty and contribute to the improvement of household living standards. Various theoretical studies investigating mechanism of migrations' push and pull factors could be found in the recent literature (Krugman & Obstfeld, 1991: 155-175; Jovanovich, 1997: 333-341; Tassinopoulos & Werner, 1998: 5-98, Massey, 1998: 362 and 1999: 5328-5335).

In order to regulate migration it is very important for us to understand why do people migrate? Ravenstein's seminal work 'The Law of Migration' provided the first systematic principles that explain the dynamics of migration (Ravenstein, 1889: 241-303). One of his general propositions of migration, the rationale behind the migration process, claims that an individual rationale decision is based on calculations of costs and benefits of migration, as factors in the place of origin operate as 'push' forces which in combination with 'pull' factors in the destination, explain migration flows. The model of Ravenstein is still regarded as the most important

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theoretical contribution in migration literature to date (Huang, Lee & Wang, 1999). Lee also attempted to explain the patterns of migration by 'Push-Pull Model' in 1960s because migration being a decision of individual or family therefore depends on characteristics of the places of origin & destination, nature of intervening obstacles and of the people. The processes and factors of migration have been widely discussed and well established in various disciplines like demography, anthropology, economics, population studies, geography and sociology in terms of push-pull factors (Brettell & Hollifield, 2000:9-137.). For example, History analyses the effects of physical and human geographic patterns, including significant physical features and environmental conditions that influenced migration patterns and shaped the distribution of culture groups today, while, Geography explains how political, economic, social, and environmental push and pull factors and physical conditions affect the routes and flows of human migration.

Thus, based on the accumulative laws, the Push-Pull-Mooring (PPM) framework is considered a foremost paradigm in migration studies. Because the factors affecting migrants' decisions for moving from one geographic area to another can be categorized into push, pull and mooring factors. The push factors refer to the negative factors that 'push out' the people from their places of origin, whereas, pulling factors are positive factors that 'pull' them into a new region (Moon, 1995: 504-524, Zimmermann, 1996: 313-342, Braun, 2004: 4-6, De Beer, 2008). However, the mooring factors refer to all life course, cultural, and spatial issues that act to facilitate or hamper migration decisions (Moon, 1995: 504-524) which have been previously labelled as 'intervening obstacles' by Lee (Longino, 1992: 23-34). The mooring factors can be viewed as a supplement to push and pull factors of migration.

Therefore, migration occurs due to various the socio-economic, demographic, cultural and natural factors and its factors vary from place to place and time to time (Ishtiaque&Ullah, 2013: 45; Bilborrow, 1987:183-203; Nabi, 1992: 81-98.; Sekhar, 1993:191-202; Yadava, 1988; Singh &Yadava, 1981:33-46). Moreover, the push factors of migration may include the adverse domestic conditions such as decline in a natural resource, natural disasters (e.g. droughts, floods, earthquakes, volcanic eruptions, storms, fire, famines, epidemics) economicnon-viable situation (economic instability, unemployment & underdevelopment, poverty, low productivity, poor living standards, deterioration of traditional livelihoods, overpopulation, agricultural decline, low wages & loss of income sources, hard & arduous nature of work, debt, absence of industries, landlessness & small size land holding, malnutrition &starvation, lack of realistic manpower policies & opportunities for advancement, technology limitations, etc)inadequate social and cultural opportunities (i.e. education, health care, recreational facilities) and oppressive treatment due to political, religious & ethnic affiliations, and/or marriage, political unrest, religious&political persecution, hostility & violence, militarization, segregation & discrimination, poor law & order situation, limits of personal freedom, village politics, etc. (De Haan, 1999: 1-47; Bogue, 1969: 753., Chang, 1996: 197-214; Bansal, Taylor & James, 2005: 98, Harris &Todaro, 1970: 126-42, Schultz, 1953; Matsuyama, 1992: 317-334; Caselli& Coleman II, 2001: 584-616; Gollin, Parente&Rogerson, 2002: 160-164; Nunn &Qian, 2011: 593-650; Barrios, Bertinelli&Strobl, 2006:357-371; Mata et al., 2007: 252-272; Yuki, 2007: 76-103). These factors combinedly may compel people to leave their native place in search of better living conditions. Nonetheless, it is unclear what personal factors and conditions will enable their transition and retention in a new place of settlement.

Objectives of the study

The present research work aims to cover the following main specific objectives:

- i. to investigate the settlement and migratory status of houseless population in Kanpur city,
- ii. to explore the pushing factors of out-migration of houseless population operating at their places of origin, and
- iii. to propose a hypothetical model about the circulations of houseless population between the Kanpur city and their places of origin.

The Study Area

Kanpur city is located in the central part of the state of Uttar Pradesh (Fig. 1). It has been the first largest as well as most populous metropolitan city of the state till Indian Census 2001. After 2011 Census, it slipped down to the second position after Lucknow (28,15,601), the capital city of the state.

According to 2011 Census, the city had a population of 2.8 million (27,67,031 persons) which made it the twelfth most highly populated city in India. The city has been known as the economic and industrial capital of Uttar Pradesh. The municipal area of Kanpur city is about 605 square kilometers. The city is administratively divided into 6 zones and 110 wards (the inner core area of Kanpur constitutes 67 wards) with an average ward population ranging between 20,000 to 25,000 persons (Kanpur City Development Plan, 2006). The data has been collected at ward level but analysis has been made at the zone level because the geographical area of wards is much smaller than zones. Moreover, the number of houseless households is higher in Zone 1 than all the zones of Kanpur city because it is the old part of the city which is characterised by high concentration of administrative, commercial and

manufacturing enterprises, high population density, good connectivity of railways & roadways, etc. that attract petty workers in large numbers.

The Zone 2 is the largest zone of the Kanpur city in terms of area, most of the wards of this zone are newly developed and witness the characteristics of both the rural as well as urban land use, excluding the few wards like Zazmau North and Zazmau South. The Cantonment, Aerodrome and C.O.D. (Central Ordnance Depot) too are the parts of this zone. The southern part in the mid of the Kanpur city is occupied by the Zone 3, through which the National Highway 86 (NH 86) i.e. Hamirpur Road passes. The Zone 4 is also characterised by older part of the city but it is more residential in character followed by the commercial activities. The Zone 5 lies in the south-western part of the city and the railway line passes through mid of this zone. No sample of houseless households has been taken from the Armapur Estate of this zone because of total absence of the houseless population in that area. The Zone 6 is one of the newly settled parts of the city nearly propelling along the Grant Trunk Road which provides broad spacious pavements for living and sleeping for the houseless population.

Database and Methodology

Present study is based on primary source of data generated through a comprehensive field survey of Kanpur city in 2012. Having identified the houseless households in prior visits in each ward, the individual slips (questionnaires) were used to ease the task of survey in the city. The information was gathered by the investigator through the direct questionnaire to the respondents face to face. Among the total 110 wards of the Kanpur city, the houseless population was found only in the 96

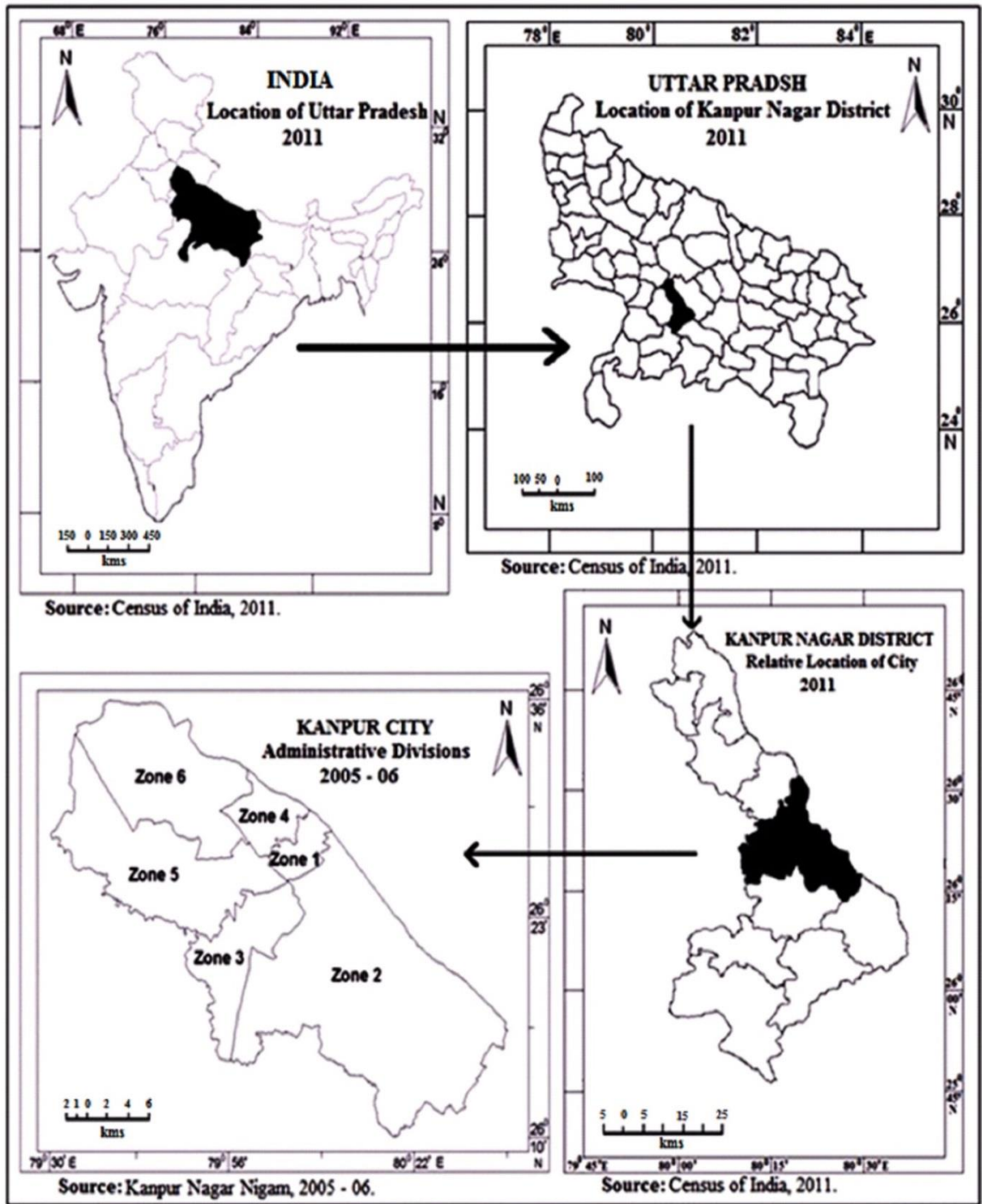


Fig. 1: Location of the Study Area (Kanpur City)

wards and Cantonment area while houselessness was not found in remaining 14 wards, Armapur estate, Aerodrome and C.O.D. (Central Ordinance Depot) areas during the survey in the city.

Ward in Kanpur city is the smallest administrative unit and houseless household has been taken as the smallest unit for data collection. For ease of understanding, the collected data were spatially presented through zone-wise limit of the city. Initially, it was planned to select 30 percent houseless households randomly from each ward. However, the three pilot surveys were carried out in the city during May, August and November in 2011, in these surveys; it was observed that the number of houseless households used to vary with time even within a day and from place to another place in an area. Thus, the four periods of time in a day i.e. early morning (6 am to 9 am), noon (12 pm to 3 pm), evening (6 pm to 9 pm) and late night (9 pm 12 midnight) were taken to carry out the survey on houseless households, in which two periods (i.e. early morning and late night) experienced the large number of houseless households due to space available for sleeping/living after closing of shops/markets, and to take rest after work as a casual workers in day time, while the other two periods (i.e. noon and evening) witnessed the small number of houseless households due to opening of shops/markets, and the working hours as people mostly used to go for jobs during day time. Moreover, some houseless households were very difficult to be identified at all, at any particular place and time due to lack of their fixed abode and hidden in nature (not easy recognisable among general public i.e. an individual man is either houseless or not), therefore, 10 per cent houseless households were considered as hidden because during pilot surveys most probably around 10 per cent households were unidentified and verified by the municipal corporation and inhabitants of the city

(Pleace, Burrows & Quilgars, 1997: 1-18 and FEANTSA, 1999).

A random sampling was used to obtain information from the houseless households. When an actual count of the houseless is attempted, it was found out that this is a highly mobile population and, thus, very difficult to be tracked and estimated accurately. Because, the problem of mobility and hidden nature of houselessness affect the estimates of houseless populations as it sometimes lead the researcher to undercounts or double counts. Consequently, the houseless households in prior visits in each ward (the boundary of the ward has been kept as the smallest administrative unit and houseless household has been taken as the smallest unit for data collection) were identified and a tentative list for them was prepared by the investigator for their easy random selection of the samples for the collection of the data.

Keeping these things in mind, a sample of 25 per cent houseless households was randomly selected for the survey from the tentative list of each ward. At last, the sampled houseless households of all the wards lying in a zone were summed up zone-wise for easy spatial data analysis. The survey consisted of 1384 houseless households of the Kanpur city whereas the total number of sampled houseless population of the city was 2353 which is summation of total houseless households (1384) and houseless households' family members (969) (see Table 1).

In the present study, the houseless population is defined as persons who do not live in a house, having few possessions with them and used to sleep and live in the informal places, not meant for human habitation, excluding the slums dwellers, nomadic tribal people (gipsies) and Hindu saints while a house is taken as a physical structure of dwelling with roof and walls as a separate unit having the separate main entrance into it from the public way'

Table-1: Zone Wise Distribution of Surveyed Houseless Households in Kanpur City

Zone No	No. of houseless households			No. of houseless households with families			No. of houseless households' family members			No. of houseless population		
	1			2			3			4 (1+3)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Zone 1	557	531	26	24	14	10	96	56	40	653	587	66
Zone 2	113	103	10	33	30	3	152	138	14	265	241	24
Zone 3	148	126	22	45	36	9	189	150	39	337	276	61
Zone 4	195	183	12	18	14	4	90	75	15	285	258	27
Zone 5	173	157	16	37	28	9	166	132	34	339	289	50
Zone 6	198	176	22	71	57	14	276	232	44	474	408	66
Total	1384	1276	108	228	179	49	969	783	186	2353	2059	294

Source: Based on primary survey, 2012.

(Shamshad, 2014: 106). However, Census enumerators are instructed 'to take note of the possible places where the houseless population is likely to live such as 'on the roadside, pavements, in hume pipes, under staircases or in the open, temples, mandaps, platforms and the like (Census of India, 1991: 64).

The Results and Discussion

Settlement Status

The percent distribution of data of houseless population by their settlement status is set out in the Table 2. This table exhibits that the problem of houselessness in the Kanpur city has its fundamental base in the rural areas of the country because the number of houseless people with rural background in various villages markedly overstepped the number of houseless people with urban background in all the zones of the city (vide Figure 2). The greater proportion of houseless male population in the whole city is also recorded by the people having rural background than their urban counterparts. The Zone 5 witnessed the highest percentage of houseless persons who have their places of origin in the villages, the percent values in descending order for Zone 3, Zone 1, Zone 4, Zone 6 and Zone 2 are 73.81, 73.36, 69.40, 66.10 and 61.17 percent respectively.

Table-2: Percent Distribution of Houseless Population by Settlement Status at the Places of origin

Zones	Male/ Female	Settlement status of houseless population			
		Towns	Villages	Not known	Total
Zone 1	Male	19.89	73.36	6.75	100
	Female	33.33	37.5	29.17	100
	Total	20.47	71.81	7.72	100
Zone 2	Male	31.07	61.17	7.77	100
	Female	40	20	40	100
	Total	31.86	57.52	10.62	100
Zone 3	Male	24.6	73.81	1.59	100
	Female	18.18	77.27	4.55	100
	Total	23.65	74.32	2.03	100
Zone 4	Male	29.51	69.4	1.09	100
	Female	41.67	50	8.33	100
	Total	30.26	68.21	1.54	100
Zone 5	Male	14.01	80.25	5.73	100
	Female	43.75	43.75	12.5	100
	Total	16.76	76.88	6.36	100
Zone 6	Male	31.07	66.1	2.82	100
	Female	27.27	63.64	9.09	100
	Total	30.65	65.83	3.52	100
Total	Male	23.46	71.7	4.85	100
	Female	32.08	51.89	16.04	100
	Total	24.12	70.18	5.7	100

Source: Based on primary survey, 2012

It has been mainly due to the male selective migration from the rural country-sides to the city for employment opportunities. These rural migrants try their best to get some works, and can do any kind of work, even the petty jobs like cycle rickshaw pulling, load rickshaw pulling, construction works, rag picking, etc. They can work as waiters, cooks, street vendors, loaders and un-loaders, cobblers, maid servants, etc. (Shamshad, 2014: 87-102). This situation is the result of large size base of rural population because nearly seventy percent population still lives in villages of the country (Census of India, 2011). As far as the settlement status of houseless female population is concerned, the percentage of houseless females from the rural background was much more than the houseless females of urban background in all the zones of the city, except in Zone 2, where the percentage of female houseless having their places of origin in urban areas remarkably exceeded the females who have their places of origin in the villages, and Zone 5, where the equal percent share was registered between the houseless females who have their places origin in towns and villages of the country.

A striking feature, as revealed by Table 2, is that houseless males overstepped the houseless females who have their places of origin in the rural areas in all the zones of the city except in Zone 3 where females were found to exceed males. On the contrary, houseless females in all the zones significantly outnumbered the houseless males who have their places of origin in the towns, barring Zone 3 and Zone 6 wherein the ratio of houseless females was lesser than houseless males. The Table 2 also shows that the places of origin of 5.70 percent houseless persons were not known due to reluctance, fear, irritation, mental illness, etc. Further, the portion of houseless persons, whose places of origin are not known, was predominated by the houseless females over the houseless males in the whole city, because most of the houseless females were mentally and physically disabled, divorced, separated, widow, run-aways, thrown-aways and old age-group who rendered as houseless on the footpaths for two square of meals in a day. The houseless people, whose places of origin are not known, were witnessed maximum in Zone 2 and minimum in Zone 4. The percent of houseless females whose places of origin are unknown, was the highest in Zone 2 and the lowest in Zone 3 but their proportion has been higher than houseless males in each zones of the city.

Migratory Status

The zone wise distribution of migrants and non-migrants has been given in Table 3. An analysis of this table shows that the number of migrants was greater than non-migrants in all the zones of Kanpur city.

Out of the total houseless households surveyed (1384), 1282 houseless households have been found migrants which is more than 90 percent of the total houseless households recorded in the Kanpur city. Out of the total migrant houseless households, males and females account 1184 and 98 respectively. The

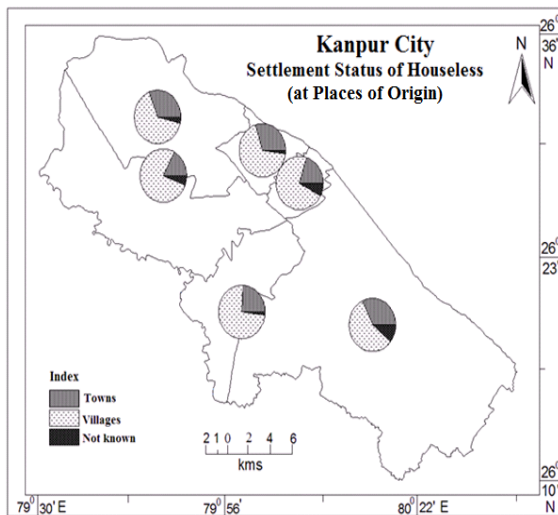


Fig.2
Source: Based on Table 2

Table-3: Distribution of Migratory Status of Houseless Households in Aligarh City

Zones	Male/Female	Migrants		Non-migrants		Total
		Numbers	Percentage	Numbers	Percentage	Numbers
Zone 1	Male	517	97.18	15	2.82	532
	Female	22	88.00	3	12.00	25
	Total	539	96.77	18	3.23	557
Zone 2	Male	88	85.44	15	14.56	103
	Female	9	90.00	1	10.00	10
	Total	97	85.84	16	14.16	113
Zone 3	Male	116	92.06	10	7.94	126
	Female	22	100.00	-	-	22
	Total	138	93.24	10	6.76	148
Zone 4	Male	160	87.43	23	12.57	183
	Female	10	83.33	2	16.67	12
	Total	170	87.18	25	12.82	195
Zone 5	Male	145	92.36	12	7.64	157
	Female	14	87.50	2	12.50	16
	Total	159	91.91	14	8.09	173
Zone 6	Male	158	89.77	18	10.23	176
	Female	21	95.45	1	4.55	22
	Total	179	90.40	19	9.60	198
Total	Male	1184	92.72	93	7.28	1277
	Female	98	91.59	9	8.41	107
	Total	1282	92.63	102	7.37	1384

Source: Based on primary survey, 2012.

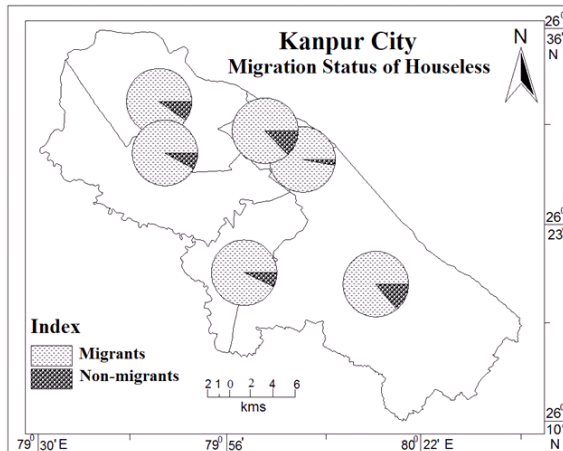


Fig.3

Source: Based on Table 3

total number of non-migrants houseless households in the city is 102, in which 93 are males and 9

females. The zone wise study reveals that the maximum number of houseless migrants has been registered in Zone 1 i.e. 539 persons, followed by Zone 6 (179 persons), Zone 4 (170 persons), Zone 5 (159 persons), Zone 3 (138 persons), and Zone 2 (97 persons). In Zones 1, 3, 5 and 6, more than 90 percent houseless households have been observed as migrants while more than four-fifth proportion of the households is recorded as migrants in the remaining Zones i.e. Zones 2 and 4 (see Figure 3).

The number of houseless migrants exceeds the number of female migrants in all the zones. The maximum and minimum houseless male migrants have been witnessed in Zones 1 and 2 respectively viz., 517 and 88 persons. The respective figures for houseless female migrants are 22 and 9 persons in Zones 1 and 2 (Zone 3 also recorded 22 houseless

female migrants in the city). Among non-migrant houseless households too, the share of males surmounts the females in the whole city.

Push Factors Out-migration

The percent distribution of data about the push factors of houseless migration has been provided in

the Table 4. It would be seen from the Table 4 that economic reasons, by far, predominate among the push factors of houseless migration in comparison to social, morbidity and natural calamities. The economic push factors account 92.16 percent for houseless migration, followed by social and morbid push factors, and natural calamities.

Table-4: Percent Distribution of Pushing Factors of Out-Migration of Houseless Population from Their Places of Origin

Zones	Male/Female	Pushing factors of out-migration				
		Social	Economic	Morbidity	Natural	Total
Zone 1	Male	4.01	94.23	1.71	0.05	100.00
	Female	13.33	68.89	15.56	2.22	100.00
	Total	4.19	93.73	1.99	0.09	100.00
Zone 2	Male	4.18	93.13	2.69	-	100.00
	Female	50.00	25.00	25.00	-	100.00
	Total	5.76	90.78	3.46	-	100.00
Zone 3	Male	5.94	92.92	0.91	0.23	100.00
	Female	12.96	85.19	1.85	-	100.00
	Total	6.71	92.07	1.02	0.20	100.00
Zone 4	Male	7.50	90.54	0.82	1.14	100.00
	Female	60.00	20.00	13.33	6.67	100.00
	Total	8.76	88.85	1.11	1.27	100.00
Zone 5	Male	3.61	95.40	0.99	-	100.00
	Female	32.00	52.00	16.00	-	100.00
	Total	4.73	93.69	1.58	-	100.00
Zone 6	Male	7.53	91.21	1.05	0.21	100.00
	Female	39.02	56.10	4.88	-	100.00
	Total	10.02	88.44	1.35	0.19	100.00
Total	Male	4.96	93.39	1.43	0.21	100.00
	Female	27.08	61.98	9.90	1.04	100.00
	Total	5.83	92.16	1.76	0.25	100.00

Source: Based on primary survey, 2012

An examination of the data given in Table 4 describes that the houseless male migrants are the result of economic push factors while female migrants were produced more by social, morbidity and natural push factors. About ninety percent houseless migrants in each zone of the city are the result of economic push factors, their range varying from 93.73 percent in Zone 1 to 88.44 percent in Zone 6. The percental array of houseless migrants produced by the social factors ranges from the

lowest 4.19 percent in Zone 1 to the highest 10.02 percent in Zone 6 and for morbidity causes, it ranges from 1.02 percent to 3.46 percent. The maximum proportion of houseless migrants caused by the natural calamities was registered 1.27 percent in Zone 4 (see Figure 4). The natural calamities which pushed the people to move from their places of living include floods, droughts, fire, etc. that damaged their agriculture, house, properties and loss of family members too.

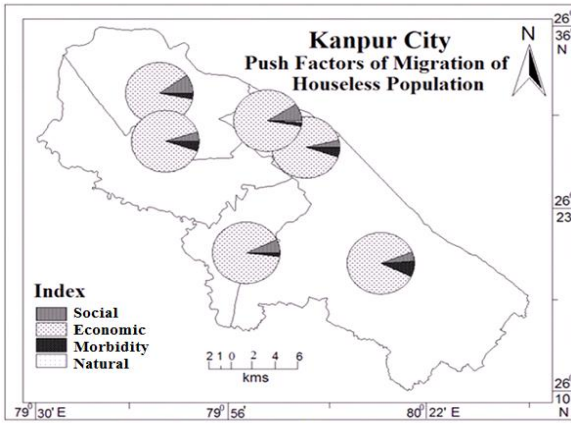


Fig.4

Source: Based on Table 4

Table 4 visualises that the share of houseless male migrants predominated the houseless female migrants in all the zones of the city among houseless migrants engendered by economic pushing factors. The male selective migration from the rural countryside to the city for employment opportunities has been occurred due to wide prevalent of unemployment & underemployment, poverty, low wages, arduous nature of work, etc. These rural poor after being failed to adjust in the rural habitat, when reach to the cities, generally, spend their nights in the open sky on the footpaths as houseless persons. Most of them do not have pure air to breathe, potable water to drink, not to mention, anything about their shelter, food and clothing (Shamshad, 2015: 348). On the other hand, the proportion of houseless female migrants, aroused by the social, morbidity and natural push factors, exceeded the houseless male migrants in each zone. However, Zones 2, 3, 5 and 6 did not witness any female migration caused by the natural calamities.

Social Pushing Factors

Table 5 exhibits the percentage distribution of data about social push factors of houseless population in the city. The data listed in Table 5 provides the information that more than two-third of the houseless migrants in the city has migrated from

their native places due to the non-availability of houses and/or space. More than two-third share of houseless migrants is also caused due to having no family, family tensions and because of marriage. It means that among all the social push factors, no house/space, no family, family tensions and marriage combinedly resulted for more than three-fourth houseless migrants in the city. Moreover, the factor of marriage/remarriage is responsible for out-migration and houselessness for some people like: “Mother brought me to the Kanpur city at the age of 3, and got me married to a beggar” (Zohra: 37, Kanpur Nagar). “My mother eloped with another man long before and my father got remarried, and I runaway from there” (Rinko: 35, Kanpur Nagar). “My mother had died and father got remarried, that is why I run-away from home as I could no longer lived there” (Imran: 26, Allahabad). “My father was a drunkard and got remarried while my mother had already passed away” (Banti: 19, Madhya Pradesh). While, other remaining social push factors namely, come in the city with parents (4.21 percent), disputes (3.51 percent), orphans (2.81 percent), throwaways (2.46 percent), large family size and un-intentional moving 1.75 percent each, substance abuse (1.40 percent), and others (3.51 percent) altogether determined only 21.41 percent houseless migrants. The category of other social push factors includes the communalism, remarriage of parents and being alone 0.70 percent each and fears of the head of the village, loss of family members, forced by relatives and love matters 0.35 percent each.

Further analysis of the Table 5 depicts that the ratio of houseless male migrants pushed by all social factors exceeded the female migrants except in the case of marriage as a social factor wherein an extraordinary opposite condition has been registered. The share of houseless migrants determined by no house/space was observed above one-third in four zones i.e. Zones 2, 3, 4 and 6 and less than one-third but more than one-fourth in Zone 1 and Zone 5.

Table-5: Percent Distribution of Social Pushing Factors of Out-Migration of Houseless Population at Places of Origin

Zones	Male/ Female	Social pushing factors of out-migration												
		No house/ space	No family	Family tension	After marriage	Come with parents	Disputes	Orphan	Thrown away	Large family size	Un-intentional moving	Substance abuse	Others	Total
Zone 1	Male	26.97	23.60	12.36	1.12	2.25	3.37	7.87	6.74	5.62	-	3.37	6.74	100.00
	Female	33.33	-	-	50.00	-	-	-	-	-	-	-	16.67	100.00
	Total	27.37	22.11	11.58	4.21	2.11	3.16	7.37	6.32	5.26	-	3.16	7.37	100.00
Zone 2	Male	57.14	21.43	7.14	-	-	14.29	-	-	-	-	-	-	100.00
	Female	33.33	50.00	-	16.67	-	-	-	-	-	-	-	-	100.00
	Total	50.00	30.00	5.00	5.00	-	10.00	-	-	-	-	-	-	100.00
Zone 3	Male	50.00	15.38	23.08	-	-	7.69	-	-	-	3.85	-	-	100.00
	Female	42.86	0.00	-	57.14	-	-	-	-	-	-	-	-	100.00
	Total	48.48	12.12	18.18	12.12	-	6.06	-	-	-	3.03	-	-	100.00
Zone 4	Male	41.30	21.74	13.04	-	10.87	2.17	-	-	-	6.52	-	4.35	100.00
	Female	11.11	11.11	22.22	44.44	11.11	-	-	-	-	-	-	-	100.00
	Total	36.36	20.00	14.55	7.27	10.91	1.82	-	-	-	5.45	-	3.64	100.00
Zone 5	Male	27.27	13.64	22.73	18.18	4.55	4.55	-	4.55	-	-	4.55	-	100.00
	Female	12.50	37.50	12.50	25.00	-	-	-	-	-	12.50	-	-	100.00
	Total	23.33	20.00	20.00	20.00	3.33	3.33	-	3.33	-	3.33	3.33	-	100.00
Zone 6	Male	61.11	8.33	13.89	-	8.33	2.78	2.78	-	-	-	-	2.78	100.00
	Female	43.75	12.50	-	43.75	-	-	-	-	-	-	-	-	100.00
	Total	55.77	9.62	9.62	13.46	5.77	1.92	1.92	-	-	-	-	1.92	100.00
Total	Male	39.48	18.88	14.59	2.15	4.72	4.29	3.43	3.00	2.15	1.72	1.72	3.86	100.00
	Female	30.77	17.31	5.77	40.38	1.92	-	-	-	-	1.92	-	1.92	100.00
	Total	37.89	18.60	12.98	9.12	4.21	3.51	2.81	2.46	1.75	1.75	1.40	3.51	100.00

Source: Based on primary survey, 2012

Further analysis of the Table 5 depicts that the ratio of houseless male migrants pushed by all social factors exceeded the female migrants except in the case of marriage as a social factor wherein an extraordinary opposite condition has been registered. The share of houseless migrants determined by no house/space was observed above one-third in four zones i.e. Zones 2, 3, 4 and 6 and less than one-third but more than one-fourth in Zone 1 and Zone 5. Further, the share of houseless male migrants caused by no house/space was greater than female migrants in all the zones except in Zone 1. Moreover, nearly

one-fourth houseless migrants produced by the no family as a social push factor were recorded in four zones (Zones 1, 2, 4 and 5). While the ratio of female migrants over-rided the male migrants in three zones namely Zones 2, 5 and 6, Zone 4 witnessed larger percent value of male migrants than the female migrants, whereas Zone 1 and Zone 3 did not record any female migrants caused by no family. It will be seen from the Table 5 that the family tensions and marriage, each accounting 20.00 percent, forced the houseless migrants to move from their native places. The highest percentage of

houseless male migrants due to family tensions and of female migrants due to marriage is observed in Zone 5. Come in the city with parents and disputes registered maximum fraction of houseless migrants in Zone 4 and Zone 2 respectively as social factors that pushed the people to render as houseless in the city while the share of other social push factors like being orphans, thrown-aways, having large family size, un-intentional moving, substance abuse and others are limited within ten percent in causing the problem of houselessness in the area under study.

Economic Pushing Factors

The data about the economic push factors for houseless migration are set out in Table 6. It will be seen from the table that the prevalence of unemployment at the places of origin of houseless population has caused nearly one-fifth of the

houselessness in the city, and absence of regular work and low wages also significantly produced the houseless migrants. Subsequently the share of houseless migrants pushed by economic factors into the city are as follows: landlessness, late payment, poverty, arduous nature of work, shyness to work, small land holdings, lack of civic amenities and others.

However, other push factors are composed of loss of land/house, no income but more expenditure and house sold (0.18 percent each), no begging scope and small towns (0.04 percent each), cheap inferior cities, house damage, low value of currency (Ganesh Prashad Shamaa: 50 and Suraj: 30, from Nepal said, "The value of Nepali currency is lower than Indian currency, that is why, we used to come here to earn and live on the footpaths") and no demand of artifacts (0.02 percent each).

Table-6: Percent Distribution of Economic Pushing Factors of Out-Migration of Houseless Population at Places of Origin

Zones	Male/ Female	Economic pushing factors of out-migration											
		Unemploye nt	Absence of regular work	Low wages	Landless ness	Late payment	Poverty	Arduous nature of work	Shyness to work	Small land holdings	Lack of civic amenities	Others	Total
Zone 1	Male	19.50	15.15	14.77	9.13	11.23	7.31	8.51	5.83	3.78	4.11	0.67	100.00
	Female	22.58	9.68	12.90	6.45	9.68	12.90	3.23	-	6.45	6.45	9.68	100.00
	Total	19.55	15.07	14.74	9.09	11.21	7.40	8.43	5.75	3.82	4.15	0.80	100.00
Zone 2	Male	23.08	14.74	12.18	8.01	9.29	10.58	6.41	6.41	3.85	5.13	0.32	100.00
	Female	66.67	-	-	-	-	33.33	-	-	-	-	-	100.00
	Total	23.49	14.60	12.06	7.94	9.21	10.79	6.35	6.35	3.81	5.08	0.32	100.00
Zone 3	Male	19.90	16.95	13.02	13.27	5.90	11.30	2.21	5.41	7.13	4.42	0.49	100.00
	Female	32.61	28.26	-	4.35	2.17	26.09	-	4.35	-	-	2.17	100.00
	Total	21.19	18.10	11.70	12.36	5.52	12.80	1.99	5.30	6.40	3.97	0.66	100.00
Zone 4	Male	19.64	13.51	13.69	10.99	9.01	9.01	8.65	4.32	6.49	3.60	1.08	100.00
	Female	-	-	-	33.33	-	33.33	-	-	-	-	33.33	100.00
	Total	19.53	13.44	13.62	11.11	8.96	9.14	8.60	4.30	6.45	3.58	1.25	100.00
Zone 5	Male	19.79	16.52	12.91	11.02	10.15	8.26	6.20	3.61	6.37	4.65	0.52	100.00
	Female	7.69	-	15.38	23.08	7.69	15.38	7.69	7.69	7.69	-	7.69	100.00
	Total	19.53	16.16	12.96	11.28	10.10	8.42	6.23	3.70	6.40	4.55	0.67	100.00
Zone 6	Male	23.39	13.53	13.30	10.09	4.36	11.70	4.13	8.26	6.19	3.90	1.15	100.00
	Female	21.74	21.74	4.35	4.35	17.39	30.43	-	-	-	-	-	100.00
	Total	23.31	13.94	12.85	9.80	5.01	12.64	3.92	7.84	5.88	3.70	1.09	100.00
Total	Male	20.24	15.10	13.89	10.02	9.49	8.69	7.05	5.59	5.02	4.20	0.71	100.00
	Female	25.21	17.65	5.88	7.56	7.56	22.69	1.68	2.52	2.52	1.68	5.04	100.00
	Total	20.37	15.17	13.68	9.95	9.44	9.06	6.91	5.51	4.95	4.13	0.82	100.00

Source: Based on primary survey, 2012

An analysis of the data given in Table 6 vividly shows that all the economic push factors caused much more male migrants compared to females, barring the factors of unemployment, absence of work and poverty which resulted more in female migrants than males. The unemployment, absence of regular work, low wages and late payment combinedly have forced more than three-fifth of the houseless people to move from their places of birth in Zone 1, and nearly same proportion of houseless migrants in Zone 2 was produced by the unemployment, absence of regular work, low wages and poverty. The factors of unemployment, absence of regular work, low wages and landlessness altogether were responsible for more than half of the houseless population to leave their native places as witnessed in Zones 3, 4, 5 and 6.

Moreover, other economic factors which impelled more than 10 percent people to move consist of poverty in Zone 3 and Zone 6, and late payment in Zone 5. The ratio of remaining economic push factors driving the houseless persons from their places of origin ranges from one to within ten percent in whole city. As may be seen from the Table 6, houseless migrants were determined by each and every economic push factor in all the zones, mainly by unemployment, absence of regular work, low wages, landlessness and poverty. However, houseless female migrants were limited in few categories under the economic push factors only in selected zones of the city.

Morbid Pushing Factors

Table 7 contains the data pertaining to morbid pushing factors of migration of houseless population. This table depicts very clearly that mental illness was the main detrimental push factor of migration which recorded 95.35 percent, followed by the parents' illness/death, blindness and depression (1.16 percent each). The houseless male migrants were also largely produced by the mental illness (94.03 percent), parents' illness/death (2.99

percent), blindness and depression (1.49 percent each), whereas, the female migrants were hundred percent decided by the mental illness. Zone wise analysis of the data shows that among the morbid pushing factors, mental illness was responsible for hundred percent houseless females' migration in all the zones of the city. Houseless male migrants were also hundred percent induced by the mental illness in Zones 4, 5 and 6, by mental illness and parents' illness/death in Zone 1 and Zone 2, and by mental illness, blindness and depression in Zone 3.

Various Socio-Economic Pushing Factors

A very detailed account of percent distribution of data about various pushing factors of migration of houseless population has been inserted in Table 8. An assessment of the data listed in this table indicates that among the socio-economic causes of out-migration, the ratios of economic causes exceeded the social causes and the number of economic pushing factors of out-migration was also larger than the social factors excluding the category of others. The economic pushing factors, namely unemployment, absence of regular work, low wages, landlessness, late payment, poverty, arduous nature of work, small land holdings and lack of civic amenities, determined more than four-fifth proportion of houseless population to migrate from their places of birth.

Whereas the social causes like shyness to work, no house/space, mental illness and no family impelled only 10.05 percent persons to migrate, while, others factors recorded merely 3.62 percent. Moreover, the unemployment and absence of regular work forced nearly one-third people to move from their native places.

Others pushing factors of migration are the composite index of family tensions, marriage, loss of land/house, natural calamities, coming/moving in the city with parents, disputes, house sold, no income but more expenditure, being orphan or

Table-7: Percentage Distribution of Morbid Pushing Factors of Out-Migration of Houseless Population at Places of Origin

Zones	Male/ Female	Morbid pushing factors of migration				
		Mental illness	Parents' illness/ death	Blindness	Depression	Total
Zone 1	Male	97.37	2.63	-	-	100.00
	Female	100.00	-	-	-	100.00
	Total	97.78	2.22	-	-	100.00
Zone 2	Male	88.89	11.11	-	-	100.00
	Female	100.00	-	-	-	100.00
	Total	91.67	8.33	-	-	100.00
Zone 3	Male	50.00	-	25.00	25.00	100.00
	Female	100.00	-	-	-	100.00
	Total	60.00	-	20.00	20.00	100.00
Zone 4	Male	100.00	-	-	-	100.00
	Female	100.00	-	-	-	100.00
	Total	100.00	-	-	-	100.00
Zone 5	Male	100.00	-	-	-	100.00
	Female	100.00	-	-	-	100.00
	Total	100.00	-	-	-	100.00
Zone 6	Male	100.00	-	-	-	100.00
	Female	100.00	-	-	-	100.00
	Total	100.00	-	-	-	100.00
Total	Male	94.03	2.99	1.49	1.49	100.00
	Female	100.00	-	-	-	100.00
	Total	95.35	2.33	1.16	1.16	100.00

Source: Based on primary survey, 2012

Table-8: Percent Distribution of Various Socio-Economic Pushing Factors of Out-Migration of Houseless Population

Zones	Male/ Female	Various socio-economic pushing factors of out-migration														
		Unemployment	Absence of regular work	Low wages	Landlessness	Late payment	Poverty	Arduous nature of work	Shyness to work	Small land holdings	Lack of civic amenities	No house/ space	Mental illness	No family	Others	Total
Zone 1	Male	18.38	14.28	13.92	8.60	10.59	6.89	8.02	5.50	3.56	3.87	1.08	1.67	0.95	2.70	100.00
	Female	15.56	6.67	8.89	4.44	6.67	8.89	2.22	-	4.44	4.44	4.44	15.56	-	17.78	100.00
	Total	18.32	14.13	13.82	8.52	10.51	6.93	7.90	5.39	3.58	3.89	1.15	1.94	0.93	3.00	100.00
Zone 2	Male	21.49	13.73	11.34	7.46	8.66	9.85	5.97	5.97	3.58	4.78	2.39	2.39	0.90	1.49	100.00
	Female	16.67	-	-	-	-	8.33	-	-	-	-	16.67	25.00	25.00	8.33	100.00
	Total	21.33	13.26	10.95	7.20	8.36	9.80	5.76	5.76	3.46	4.61	2.88	3.17	1.73	1.73	100.00
Zone 3	Male	18.49	15.75	12.10	12.33	5.48	10.50	2.05	5.02	6.62	4.11	2.97	0.46	0.91	3.20	100.00
	Female	27.78	24.07	-	3.70	1.85	22.22	-	3.70	-	-	5.56	1.85	-	9.26	100.00
	Total	19.51	16.67	10.77	11.38	5.08	11.79	1.83	4.88	5.89	3.66	3.25	0.61	0.81	3.86	100.00
Zone 4	Male	17.78	12.23	12.40	9.95	8.16	8.16	7.83	3.92	5.87	3.26	3.10	0.82	1.63	4.89	100.00
	Female	-	-	-	6.67	-	6.67	-	-	-	-	6.67	13.33	6.67	60.00	100.00
	Total	17.36	11.94	12.10	9.87	7.96	8.12	7.64	3.82	5.73	3.18	3.18	1.11	1.75	6.21	100.00
Zone 5	Male	18.88	15.76	12.32	10.51	9.69	7.88	5.91	3.45	6.08	4.43	0.99	0.99	0.49	2.63	100.00
	Female	4.00	-	8.00	12.00	4.00	8.00	4.00	4.00	4.00	-	4.00	16.00	12.00	20.00	100.00
	Total	18.30	15.14	12.15	10.57	9.46	7.89	5.84	3.47	5.99	4.26	1.10	1.58	0.95	3.31	100.00
Zone 6	Male	21.34	12.34	12.13	9.21	3.97	10.67	3.77	7.53	5.65	3.56	4.60	1.05	0.63	3.56	100.00
	Female	12.20	12.20	2.44	2.44	9.76	17.07	-	-	-	-	17.07	4.88	4.88	17.07	100.00
	Total	20.62	12.33	11.37	8.67	4.43	11.18	3.47	6.94	5.20	3.28	5.59	1.35	0.96	4.62	100.00
Total	Male	18.90	14.11	12.98	9.35	8.86	8.12	6.58	5.22	4.69	3.92	1.96	1.34	0.94	3.03	100.00
	Female	15.63	10.94	3.65	4.69	4.69	14.06	1.04	1.56	1.56	1.04	8.33	9.90	4.69	18.23	100.00
	Total	18.77	13.98	12.61	9.17	8.70	8.35	6.37	5.08	4.56	3.81	2.21	1.68	1.08	3.62	100.00

Source: Based on primary survey, 2012

thrown-away, large family size, un-intentional moving, substance abuse, communalism, being alone, parents remarriage, parents' illness/death, no begging scope, small towns, fear of the head of the village, no demand for artifacts, blindness, depression, low value of currency, inferior city, loss of family members, house damage, being forced by relatives and love matter, which altogether registered 3.62 percent of houseless migrants in the city. The respective figures for houseless males and females were 3.03 and 18.23 percent. The ratio of houseless male migrants was recorded higher than the females in all migration inducing categories excluding a few namely poverty, no house/space, mental illness, no family and others, in which, females overstepped the males. It is also very interesting to note here that the houseless female migration inducing factors were mainly social in nature while male migration was decided mainly by the economic factors.

The unemployment was observed as the most significant push factor of houseless migration in all the zones, varying from the lowest 17.36 percent in Zone 4 to the highest 21.33 percent in Zone 2. The socio-economic causes of houseless migration which determined the volume of migration above ten percent are limited in few categories. For example, the problem of unemployment, absence of regular work and low wages each forced more than ten percent houseless people to migrate from their places of origin to the Kanpur city as witnessed in all the zones of the city. Landlessness in Zone 3 and Zone 4, late payment in Zone 1 and poverty in Zone 3 and Zone 6 also have been contributing more than ten percent houseless in-migrants in the city. Moreover, all the socio-economic push factors of migration of houseless population were observed to have contributed more than one percent as a cause of migration in each zone barring the factor of having no family which accounted less than one percent.

A Hypothetical Model of Spatial Flows of Houseless Population

The real universal fact is very clearly revealed from the Illustration 1 that the volume of flow of houseless population is inversely related to the distance because flow of houseless population to the Kanpur city from other countries of the world and Indian states excluding state of Uttar Pradesh combinedly was registered only 10.63 percent houseless migrants while remaining proportion (89.37 percent) of houseless population have their places of origin within the state of Uttar Pradesh. Moreover, among the houseless population who originated within the state of Uttar Pradesh and flown from there towards the city, nearly half proportion (44.05 percent) of houseless persons were accounted by only four neighbouring districts of Kanpur city namely Kanpur Nagar itself (23.72 percent), Unnao (10.06 percent), Fatehpur (6.68 percent) and Kanpur Dehat (4.04 percent). Likewise, as the distance of the districts from the city increases, the volume of houseless migrants also decreases and vice versa. Moreover, the larger proportion of houseless population in the Kanpur city has migrated from the districts of Eastern Uttar Pradesh rather than Western Uttar Pradesh because the city itself is the part of Eastern Uttar Pradesh.

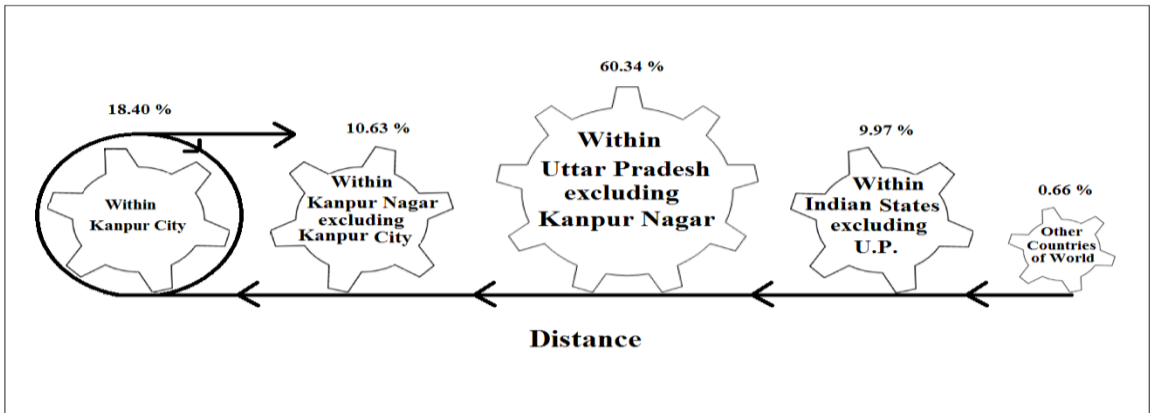
Thus, the models like large number of migrants move to a short distance (Raventein, 1989), gravity or distance decay (Newton, 1729 and Stouffer, 1960) i.e. the movement of persons between two centres would be directly proportional to the product of their population and inversely proportional to the square of distance between them (Reilly, 1929 and James, 1972), power of any area to attract people, goods and information depends on its size of its economic base and distance (Zipf, 1941 and 1949; Jones, 1981 and Stewart, 1950), etc. have been also proven by this hypothetical model (see Illustration 1). However, Illustration 1 has disproven the migrants' stability that 'how long' a migrant would

like to stay at a place.

For instance, out of the total surveyed houseless households in the city, only 18.40 percent houseless households have their places of origin within the city while remaining proportion (81.60 percent) of houseless households belonged from outside of the city. The houseless people, who are unable to access the shelter in their whole lives and, thus, forced to live as houseless on the footpaths, accounted 38.21 percent share of the total houseless population found in the Kanpur city. This section of houseless population is comprised of those people who have

their places of origin within the Kanpur city (18.40 percent) and nearly one-fifth proportion (19.81 percent) of houseless who have migrated from outside of the city. This segment of houseless population (38.21 percent) is continuously on move within the city as revealed by a curving downward arrow in last circle of Illustration 1, while, remaining proportion (61.79 percent) of houseless population, who used to get the chance to live in the shelter after either few months or few years, have been continually circulating between their places of origin and Kanpur city as indicated by straight arrows in Illustration 1.

Illustration 1: Places of Origin of Houseless Population and their Circulations



Source: Based on the simplification of primary data by the researcher

Conclusions and Suggestions

The overall analysis of the article shows that the problem of houselessness has its fundamental base in the rural areas of the country as the number of houseless people who have their rural background markedly overstepped the number of houseless people with urban background in all the zones of the city. It has been mainly due to the in-migration of people from the rural country-sides to the city for employment opportunities because the number of migrants was greater than non-migrants in all the zones of the city. The houseless in-migrants of the city have been out-migrated from their places of origin by various geo-climatic and socio-economic

pushing factors of migration. The economic reasons, by far, predominated among the push factors of houseless migration in comparison to social, morbidity and natural calamities, because more than ninety percent houseless persons have been out-migrated from their places of origin by economic pushing factors.

Notwithstanding, among the social push factors of out-migration of houseless population, more than two-third of the houseless in-migrants in the city has out-migrated from their native places due to the non-availability of houses and/or space and more than two-third share of houseless migrants was also

caused due to having no family, family tensions and because of marriage. It means that no house/space, no family, family tensions and marriage combinedly resulted for more than three-fourth houseless immigrants in the city. Remaining proportion of houseless people have out-migrated from their places of origin due to the disputes, come in the city with parents, orphan, throwaways, large family size, un-intentional moving, substance abuse, communalism, remarriage of parents, being alone, fears of the head of the village, loss of family members, forced by relatives and love matters.

Further, the prevalence of unemployment, among the economic push factors of houseless out-migration at the places of origin, has caused nearly one-fifth of the houselessness in the city, absence of regular work and low wages also significantly produced more than one-fourth houseless immigrants, and more than one-third houseless immigrants in the city was the outcome of landlessness, late payment, poverty and arduous nature of work operating at the places of origin. Subsequently the remaining share of houseless migrants pushed by economic factors into the city were like, shyness to work, small land holdings, lack of civic amenities, loss of land/house, no income but more expenditure, house sold, no begging scope, small towns, cheap inferior cities, house damage, low value of currency and no demand of artifacts.

Nearly two percent houseless persons have out-migrated from their native places due to the morbidity and natural calamities, in which, mental illness was the main detrimental push factor of migration which recorded more than ninety five percent houseless persons, followed by the parents' illness/death, blindness, depression and natural disasters (droughts, floods, storms, fire, etc). At last, taking the socio-economic causes of out-migration as a whole, the ratios of economic causes exceeded the social causes and the number of economic pushing factors of migration was also larger than the

social factors excluding the category of others. The economic push factors, namely unemployment, absence of regular work, low wages, landlessness, late payment, poverty, arduous nature of work, small land holdings and lack of civic infrastructural facilities, determined more than four-fifth proportion of houseless population to out-migrate from their places of birth, whereas the social causes like shyness to work, no house/space, mental illness and no family impelled only one-tenth percent persons to migrate.

As far as the circulation of houseless population between their places of origin and Kanpur city is concerned, it shows that the majority of houseless population found in the Kanpur city has its background in different districts of Uttar Pradesh excluding Kanpur Nagar district, followed by people from within the Kanpur city, within Kanpur Nagar district excluding Kanpur city, within Indian states excluding Uttar Pradesh, and other countries. Therefore, the volume of flow of houseless population has inverse relationship with distance from the Kanpur city because flow of houseless population from other countries of the world and from Indian states excluding state of Uttar Pradesh combinedly was registered only 10.63 percent while remaining proportion of houseless population have their permanent residential base in the state of Uttar Pradesh.

It has been generally assumed that the urban areas have much poor living conditions than the rural areas particularly in the developing countries of the world due to wide prevalence of urban problems like unemployment, underemployment, poverty, malnutrition & under nutrition, starvation, trafficking or crime, corruption, begging, slum & squatter settlements, homelessness, traffic congestion, shortage of portable water, electricity, child delinquency, segregation or regionalism, etc. Nevertheless, truly speaking, these urban problems

are not generated within the urban context but they are largely imported from the rural country-sides to the cities by the process of in-migration because for the rural poor people, the space is continuously shrinking in terms of size of land holding, forests cover, ponds, meadows for rearing animals, high cost of agricultural inputs & building materials, increasing land value, sources employment/work, housing conditions & room occupancy, etc. due to the exponential population growth in the rural areas of the country.

The root of the problem of houselessness in the city lies in the rural areas of the country because more than seventy percent houseless people have come with a rural background in the various villages.

Further, 84.48 percent houseless people have been recorded as workers. Therefore, the employment opportunities in rural areas of the country must be developed to curb the heavy influx of rural migrants in the city. It is the need of the hour that an act of 'Work for All' should be passed by the government to provide the employment opportunities for all kinds of persons at their native places according to their ability for the whole year throughout the country, regardless of the ambitious MNREGA programme. Moreover, In order to achieve this end, the subsidiary employment opportunities can also be provided by developing small scale household industrial units, and agro-based, agro-allied and ancillary industries like animal husbandry, poultry farms, fisheries, horticulture, floriculture, dairy, piggery, apiculture, silviculture, sericulture, etc. during agricultural slack seasons. In addition to it, MNUEGA (Mahatma Gandhi National Urban Employment Guarantee Act) on the guidelines of MNERGA (Mahatma Gandhi National Rural Employment Guarantee Act) should also be launched to provide whole year work for the urban poor marginalised people so that they can also earn the means for two square meals in a day.

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Spatial Analysis of Urban Sprawl: A Case Study of Bhubaneswar City

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Abstract

Urbanization is growing quickly over the planet. In developing cities, the rate of urbanization and population increase are directly correlated. The city's land use pattern is drastically altered by rapid urbanization. Odisha's smart city, Bhubaneswar, is located between 20°14'0" N and to 20°15'40" latitude and between 85°51'31" and 85°52'45" E longitude is feeling the effects of growing urbanization. Rapid urbanization has resulted in significant changes in the city's LULC, which over time have led to a sharp decline in the amount of dense vegetation cover, water bodies, and agricultural land. Similar terrain changes, unchecked slum area growth, and unlawful land invasion are some of the main issues seen during this urban sprawl. Land values have increased significantly in and around Bhubaneswar City as a result of the rapid population growth. For the purpose of choosing, planning, and implementing land use plans to satisfy the rising demand for fundamental human requirements and welfare, information on LU/LC and their potential uses are crucial. This study's primary goals are to map urban sprawl and examine the spatiotemporal changes in land use in the city. The most effective instrument for mapping and tracking the spread of urban habitations is presently geoinformatics, which is powered by temporal high-resolution satellite photos, Geographic Information Systems (GIS), mobile technologies, etc. In this article, an effort is made to analyze the dynamics of urban spread in the

Indian state of Odisha's capital city of Bhubaneswar. It was discovered that uncontrolled urban sprawl is gradually becoming the cause of drain water blockage, and urban health issues, the production of urban garbage, etc. The growth of the city is peripheral. The growth rate in the core part of the city is 2 -2.5% per year and the annual growth rate in peripheral words is about 4.4%. The driving forces for the growth are mainly the development of IT sectors as well as the economic booms in the automobile sector which forms the major portion of the industries and commercial sectors in and around Bhubaneswar city. As there is no major physical barrier the city is growing in every direction from the core.

Keywords: Urbanisation, Landuse Land Cover, Change detection, GIS.

Introduction

World is navigating towards urbanization very rapidly. Every country is witnessing development due to the advancement of technology in the field of industrial growth and the IT sectors. Most of the developed countries are going to attend saturation in the field of Urbanisation whereas the developing countries are still in the growing stage of the urban process. India like a country still trying to reach the process of urbanization to accommodate the maximum area to be a footprint in the world scenario. As it is found that the world in 1950 has about 751 million urban population whereas in 2019

it reaches 4.46 billion in number. In 2019 Urban population of India was 35.4% over the last 50 years. India's urban population increases significantly from 20.3% to 35.4%. Urbanization is just another name for urban sprawl. It alludes to the movement of people from densely crowded cities and towns to sparsely inhabited areas spread out across increasing amounts of rural territory. As a result, a city and its suburbs are dispersed over an increasing number of rural regions. Low-density residential and commercial construction on undeveloped land is referred to as urban sprawl. People frequently relocate from these locations to reside. Since the dawn of time, this has been how things have been. Sprawl is not something that is

only now becoming fashionable; it has been there for a long time, and cities and their suburbs are now getting congested.

In the name of progress, urban expansion is consuming valuable farmland and wildlands, leaving us with fewer green areas and valuable wildlands, including bogs that are being drained and paved over, endangering important animal habitats and species. More pollution, more carbon emissions, and more traffic. Yet, sprawl is not always the product of bad planning and narrow-mindedness. Urban sprawl is a word that is thrown about a lot these days. It has become the cry that urges everyone to try to control what is known as urban growth.

Study area

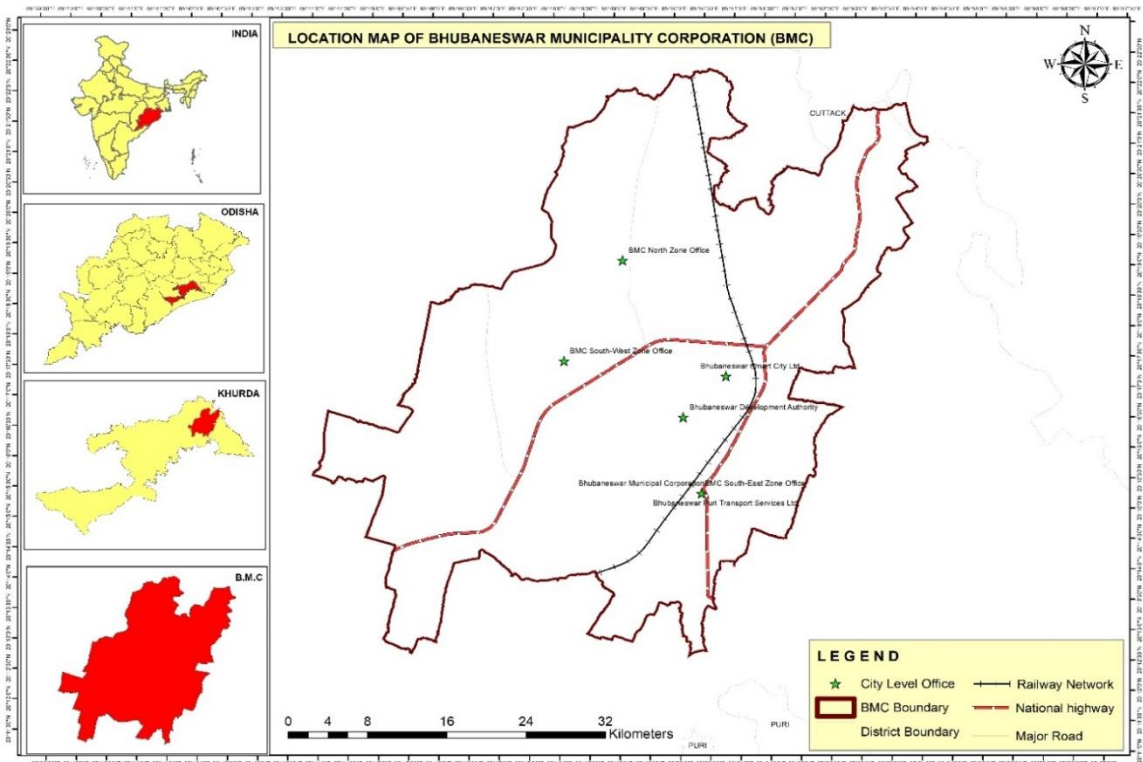


Fig.1: Location area map

Bhubaneswar the capital of Odisha is located on the eastern coast of India and known as the Temple city, with an extension of 20°12'0"N and 20°23'0"N Latitude and 85°44'E and 85°54'E longitudes. It has an area of 270sq.km. In 1948, on 13th April Bhubaneswar was declared the capital of Odisha designed by German Architect Dr. Otto Koeingsberger. Topographically Bhubaneswar forms an undulating hilly terrain with an average elevation of 45 meters above the mean sea level. It can be divided into two important parts: western uplands and eastern lowlands. Mostly the soil of the study area is hard red lateritic in the north and western parts.

The eastern and southern part consists of alluvial soil due to the presence of rivers and flood plains is very good for agriculture. The humid tropical climate is prevailing in this region. Broadly the city and its surrounding are covered by tropical moist deciduous types of vegetation. The population of the study area in approximately 12 lakhs by 2020.

Problem of the study area

The city is growing very rapidly due to immigration, job opportunities, and a better, lifestyle. First, it has horizontal growth and now it shifting towards vertical growth. When it was planned it has a vision of 40,000 population. Accordingly, the masterplan was done. Now it has already accommodated about 12 lakhs of the population within this short span of time. Accommodation and provisions for a better life for the city dweller is a major problem now for Bhubaneswar.

Objective of the study

1. To study the spatiotemporal change of landuse landcover of Bhubaneswar City
2. To study the effects of Urban sprawl on the environment
3. Policies and planning for effective management of urban sprawl.

Database and Methodology

The data used for the present study include GIS and Remote sensing images during the year 2000 to 2020 of Bhubaneswar city. Data has been extracted from multi spectral and multi temporal satellite image and toposheets. To analyze the change, trends, pattern of the study area and to understand the spatial spread of the city like built-up land, vegetation, waterbodies, agricultureland, and waste lands ArcGIS map and thematic layers are used as base map for analysis. The images which are acquired are pre-processed and marked according to the boundary of the city areas. Ancillary data such as existing landcover maps and google map were integrated in the study. Population data for the census years of 2000 to 2019 was also used to predict population growth for the future and analyze the pattern of urban sprawl or growth.

Review of Literature

Throughout the past few decades, the knowledge of land-use/land-cover change has evolved from simplicity to reality and complexity. Early studies focused mostly on the physical side of the shift, but later research agendas focused on global environmental change. Because of the alteration in land use and cover, scientists discovered that land surface processes affect climate. It was realised in the middle of the 1970s that changing land cover affects surface albedo, which influences surface atmosphere energy exchanges, which affects regional climate (Otterman, 1974; Charney and Stone, 1975; Sagan et al. 1979).

The effects of changing land-use/cover on the ecosystems, products, and services were further recognised across a much wider spectrum. The effects on biotic diversity globally (Sala et al. 2000) and soil degradation are of particular concern.

In the past, people have altered the land to get the things they needed to survive, but this wasn't done at the same rate as it is now.

At local, regional, and global levels, the recent high rate of extraction has resulted in previously unheard-of alterations in ecosystems and environmental processes. Nowadays, changes in land use and land cover include issues like climate change, the dwindling of biodiversity, and pollution of the air, soil, and water. Researchers and policy makers worldwide now place a high premium on monitoring and mitigating the negative effects of land use/land cover change while maintaining the production of key resources (Erle and Pontius, 2007).

Unsustainable human activities are a major environmental problem since they are degrading the water supply.

The connection between land use and water quality aids in recognising risks to rivers' water quality, and it helps people comprehend how important access to sanitation is for human life (Parveen et al., 2015). (2017) Praveen et al.

Existing Research on Land Use and Land Cover Change: - The majority of the terrestrial biosphere has been altered by human populations and land usage into anthropogenic biomes. A number of novel ecological patterns and processes have emerged as a result of this transition, which has been important for more than 8000 years (Ellis, 2011).

Several different types of scholars have recently become interested in issues with LULC transformation, from those who prefer studying spatio-temporal patterns of land conversion to others who attempt to understand the origins, implications, and consequences (Verburg et al. 1999; Brown et al. 2000; Theobald, 2001).

Changes in the land cover have an impact on land usage, and the reverse is also true. Yet, a change in either is not always the effect of the other. The deterioration of the land is not always implied by changes in land cover due to land use. Land cover

changes, however, are a result of several altering land use patterns that are influenced by several societal factors. These modifications have an impact on systems such as biodiversity, water and radiation budgets, and others that affect the climate and biosphere. (Riebsame et al. 1994).

Despite being constrained by physical limitations, human activities that are primarily driven by socioeconomic considerations result in changes in both undeveloped and developed land (Long et al. 2007).

A significant amount of the earth's land surface has been changed via land use change, including land conversion from one type to another and land cover alteration through land use management. The objective is to meet the urgent needs of humans in terms of natural resources (Meyer and Turner, 1992; Vitousek et al. 1997).

The need to supply food, fibre, water, and shelter for more than six billion people is driving changes to the world's forests, farmlands, rivers, and air. In recent decades, croplands, pastures, plantations, and urban areas have all increased globally. With this development come significant increases in energy, water, and fertiliser use as well as significant losses in biodiversity (Foley et al. 2005).

Analysis

In an urban area the ecological habitat rapidly being disturbed due to the increase of population, industrial development, as well as economic development. Especially it well marked in the field of landuse and landcover changes, a lot of forest, agricultural land, open space, natural drainage, animal habitats are being lost for shake of human habitation. City expands to accommodate the increased population in and around its core areas. The fringe of an urban area is growing rapidly for the high-rise buildings and others ancillary facilities. Increasing Urbanisation and industrialisation is

resulting in accelerating the growth of existing urban centers and causing faster rate of spatial growth. Urbanisation in developing countries has produced a large concentration of urban squatters/slums and irregular and unplanned commercial activities which are in the marginal locations and unhygienic areas exposed to periodic and seasonal floodings, prone to health hazards and related other problems. Bhubaneswar city is also facing the similar problems, due to the presence of about 100 number of major and minor /small slum developments in and around. Here the sprawl has been developed mostly all along the major highways and the open space which kept for the future development. Bhubaneswar is one of the first growing city in eastern India is being delineated to the presence of reserve forest in the north western part and the river and its flood plain in the eastern part.

The city master planned based on Grid Iron pattern, City beautiful concept and unit pattern, initially evolved in rectangular shape outward from the main transport route i.e, National highway 5 now is 16. The internal and external road network is expanding very rapidly as per the developmental plan given by the Indian Institute of Technology for year 2030. The development of Urban Sprawl in Bhubaneswar city is consuming peripheral lands which results in a large-scale land-use change. The growth of the city towards its fringe area has no proper planning and most of the land is owned by private companies.

Table-1: Population data of Bhubaneswar city.

Year	Population	Decadal Growth Rate (%)
1951	16,512	-
1961	38,211	131.41
1971	1,0,5491	176.07
1981	2,19,211	107.80
1991	4,11,542	87.74
2001	6,48,032	57.46
2011	8,85,363	37.95
2019	11,94,000	33.55

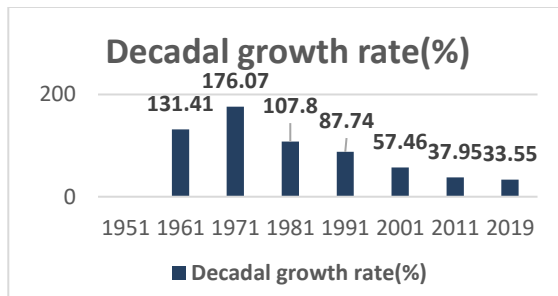


Fig.2

The table indicates that there is a persistent rise in urban population from the year 1951-2019, i.e., 16,512 in 1951 to 11,94,000(projected data) in 2019. Whereas the decadal population growth rate is showing a downward trend i.e., 131.41% in 1961 to 33.55% in 2019. In the initial stage, the major driving factor behind the decline in population growth is the fall in the fertility rate. Along with that migration also plays an important role in reducing decadal growth.

Landuse and landcover classification of Bhubaneswar city (2000-2020)

Table-2

LU/LC	AREA% (2000)	AREA% (2005)	AREA% (2010)
Residential Urban/other	17.87	22.08	27.26
Commercial/Industrial	2.27	2.34	2.89
Public/semi-public	3.68	4.39	4.85
Recreational	2	2.02	2.09
Agricultural land	31.63	30.33	24.59
Forest	17.21	15.39	12.04
Public utility/Transportation	1.15	1.32	1.38
Transportation	1.02	1.06	1.24
Wasteland	4.14	2.97	1.31
Vacant Land under development	9.39	9.61	13.87
Vacant land within the developed area	3.2	3.17	3.1
Water bodies/wetland	4.93	4.9	4.94
others	2.5	1.61	1.67

In this study the analysis has been made for the year 2000, 2005, 2010, 2012 and 2019. As per the year 2000 the agricultural land is found dominant then other land use, about 8784 hectares followed by forest land 4778.24 hectare. Vegetation is also more

than half of the agricultural land. The total residential area is 4963.77 hectares and the institutional area is 1022.8 hectare. The vacant land covers about 3497.5 hectares.

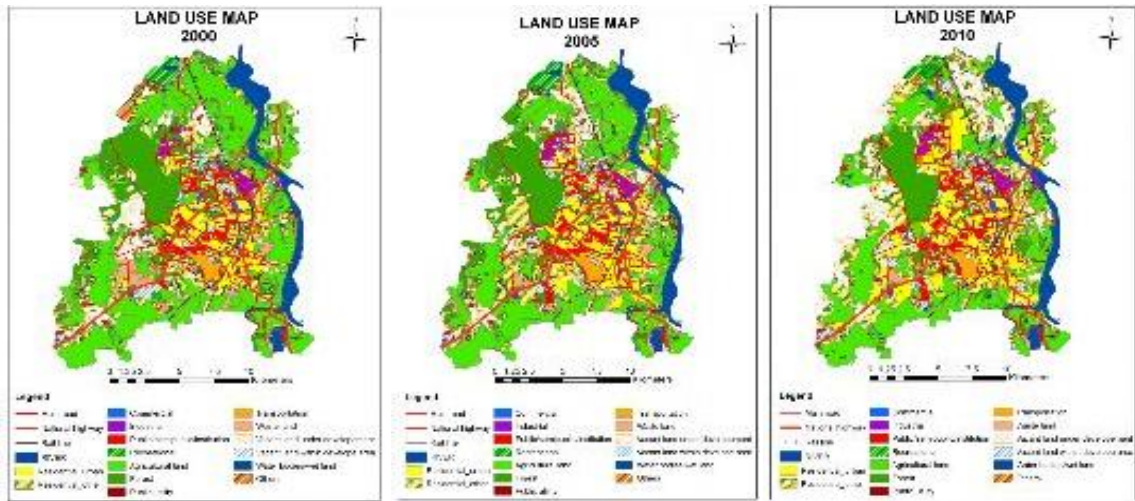


Fig.3: Land use/land cover map of Bhubaneswar city 2000, 2005, 2010

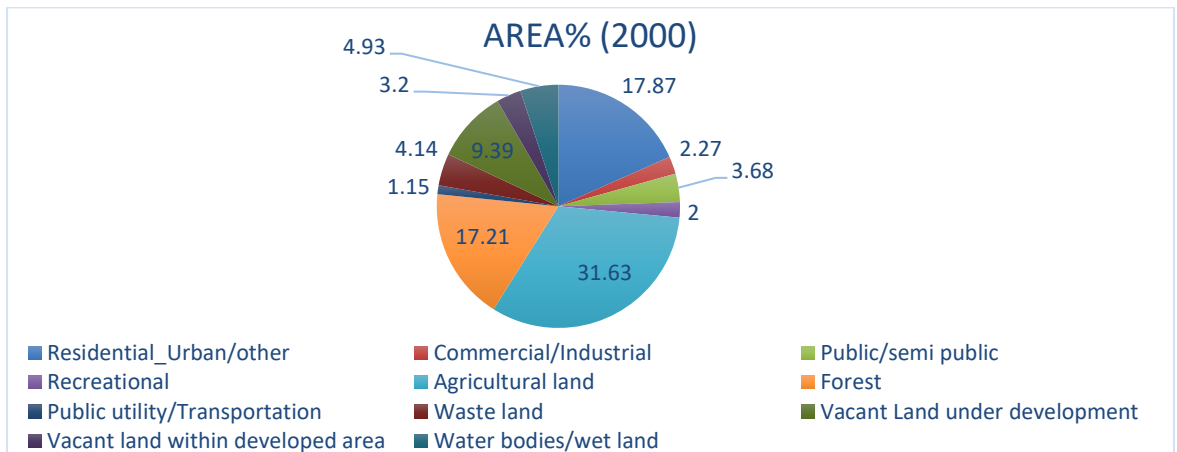


Fig.4

Wasteland, Waterbodies, and others are 1150.13 hectares, 1369.57 hectares, and 696.43 hectares. Public utility is very little and about 271.69 hectares. The scenario has been changed when the 2005 data has been analysed from the prepared map. About more than 300 hectares found less in

agriculture and about 500 hectares in forest land. The subsequent growth in residential institutional land use has been increased. (Table no -2) remarkable changes have not been there in the commercial land use.

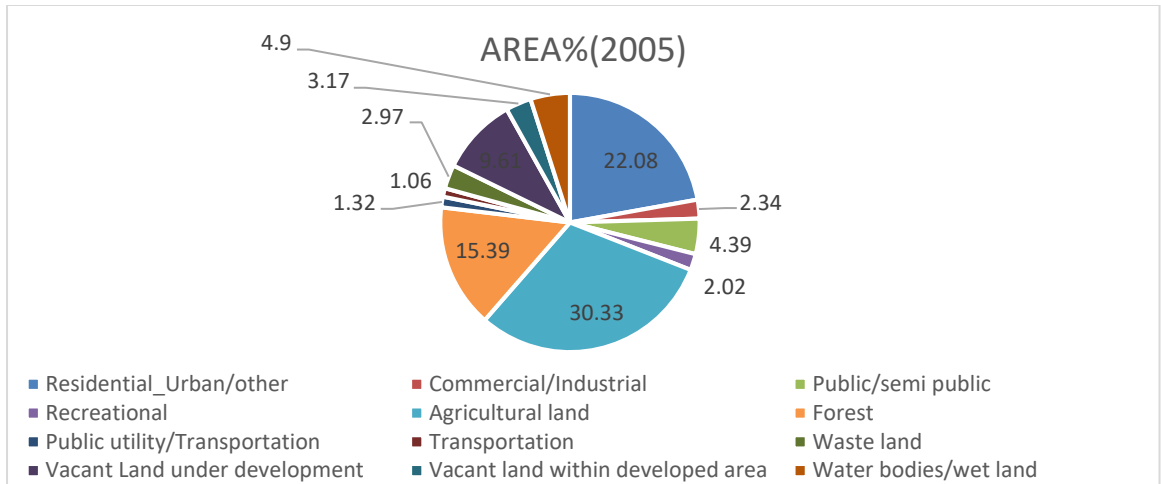


Fig.5

In 2010 agricultural land is 6827.15 hectares and forest land was 3343 hectares. The total residential area raised to 7568.8 hectares and the institutional area is 1347 hectares. Also commercial land raised to 320.92 hectares. (Table no-3)

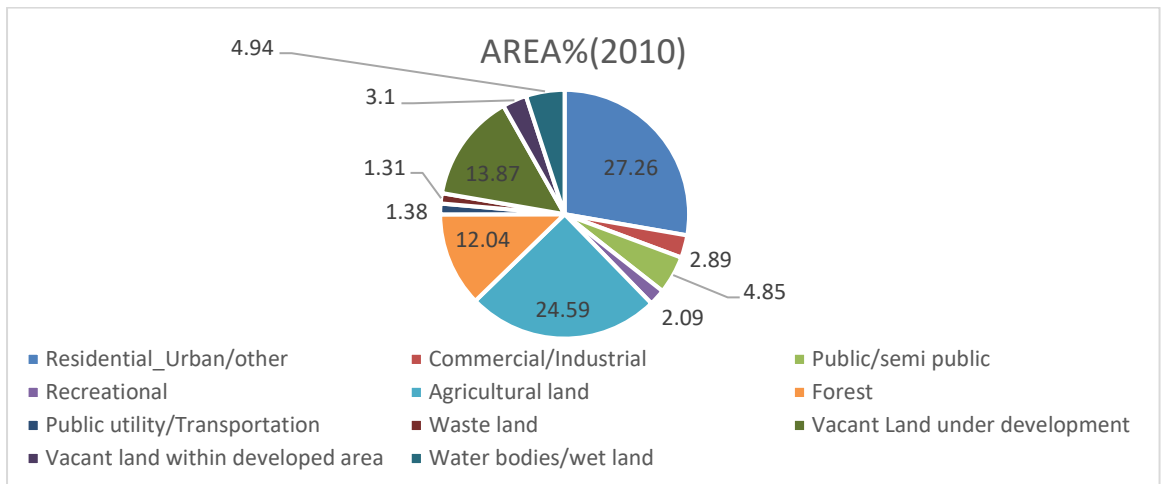


Fig.6

It has been found that the agricultural forests experienced most of the changes between 2000 and 2010. In 2010, residential areas increased from 17.87% in 2000 to 27.26%. Much of the agricultural and woodland lands have been turned into residential and institutional areas as a result of

immigration. Vertical expansion increased the price of land.

The conversion of unoccupied land from agriculture has also risen. The percentages of agricultural and forested land in the table are 31.63% and 17.21%, respectively. It was 30.33% in 2005, 15.39% in

2010, 24.59% in 2015, and 12.04% in 2010. The need to build more homes has driven the conversion of agricultural land in the periphery. Most of the forest lands (part of Chandaka) were taken by land mafias and builders with the help of authorities, who turned them into residential or institutional space for their personal gain.

The following changes have been noticeable when comparing the land use analyses from 2012 and 2019. 2012 saw a remarkable decline in agricultural land usage to just 2008 hectares, indicating a need for the land for other use. While the area used for habitation or built-up areas expanded to 8755.986 hectares. The forest's size decreased to 1901.57 hectares as well. The waterlogging marsh region swelled here as the city's development caused the surrounding land to develop as well. Moreover, other classifications such as canals, ponds, scrubland, drains, and transportation have been statistically coded for 2012.

Table-3: LU/LC Classification from 2012-2019.

LU/LC	AREA (ha) 2012	AREA (ha) 2019
Built-up (transport)	1628.36	2008.29
Agricultural land	1618.99	3909.86
Built up (housing/ utilities/services)	6658.83	8812.29
Built up(industrial)	291.26	51.65
Built-up (rural)	22.54	427.56
Construction/infrastructure unit	175.86	
Surface water bodies	331.96	519.08
Vacant land(rural)	81.16	
Vacant land (urban)	2176.69	
Vegetation/ Forest land	600.16	838.68
Wastelands/ Underutilised lands/Scrub lands	606.6	1020.9
Wetland	57.35	445.4

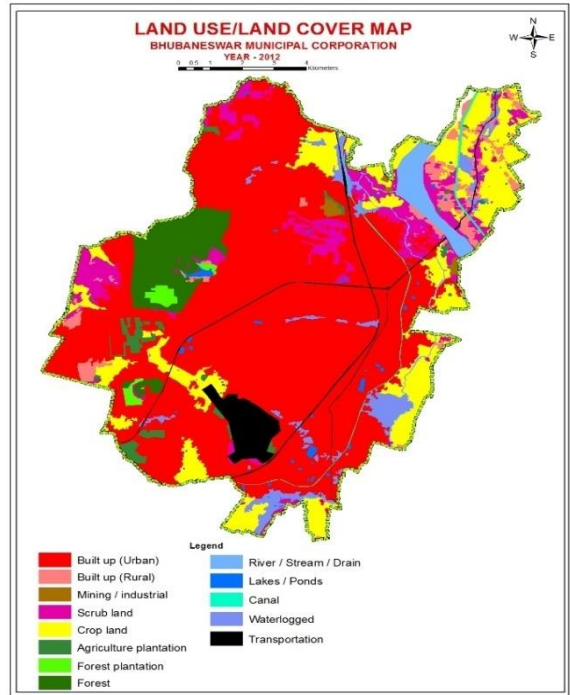


Fig.7

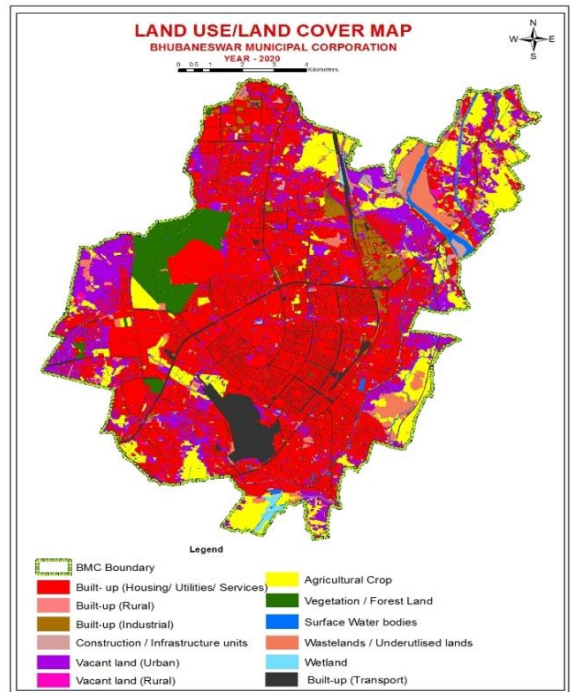


Fig.8

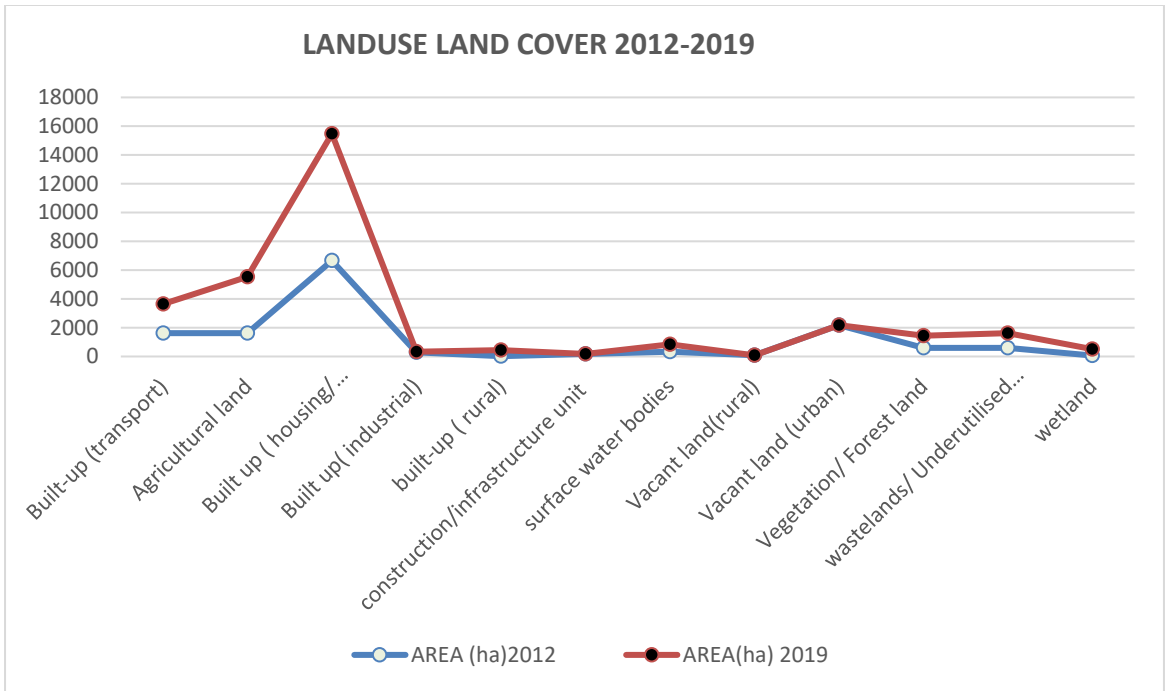


Fig.9

Growth of Urban sprawl Bhubaneswar city

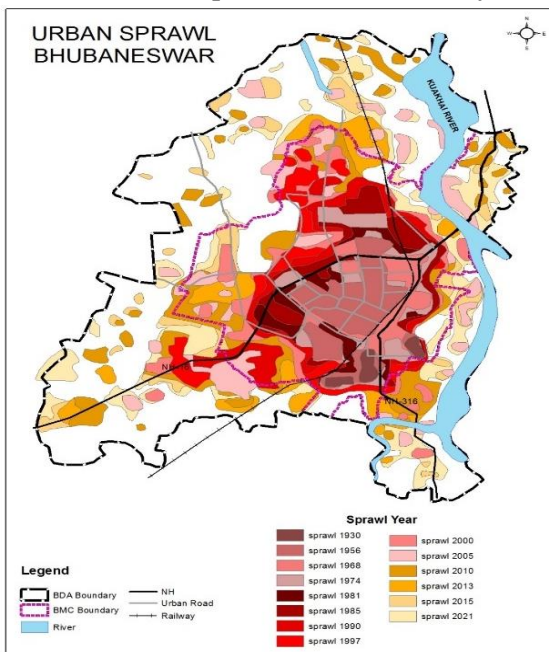


Fig.10

Urban sprawl causes

1. *Lower land rates*- lower cost of land and open spaces attract people to live in suburbs.
2. *High standard of living*- they can pay quickly and commute larger distances.
3. *High-cost infrastructure and land taxes* towards core areas force people to live in suburbs (middle class).
4. *Low small-scale ancillary industries* are set up in suburbs as they can easily borrow land at a low cost.

Effects of sprawl

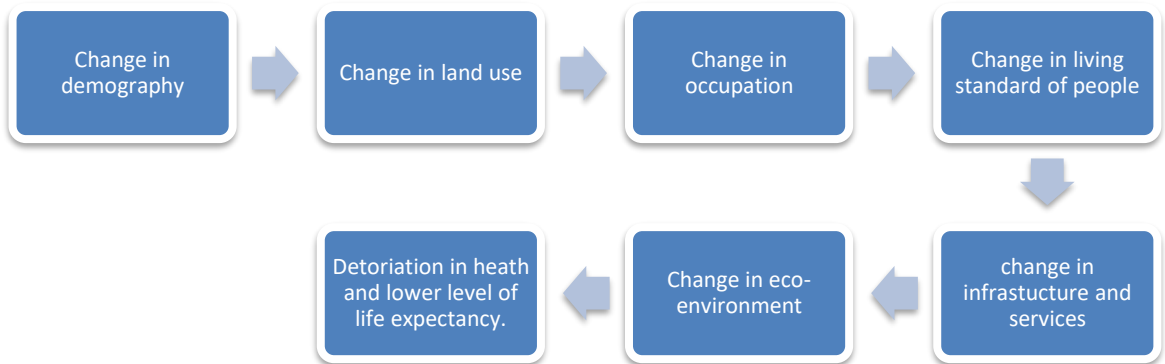


Fig.11

Direction of current city

Bhubaneswar is considered the most densely populated and most rapidly urbanizing city in eastern coastal plain of Odisha both in terms of urban population and no. of towns. The city was planned originally for 40,000 people with an area of 1684 hectares of land and now it is accommodating about 11,94,000 population. The shape of present city has assumed a rectangular form which means development of the town was on vast unutilized undulating plateau. Now the city has extended on all four directions engulfing in the fringe villages. The extension has got varied length and dimension from the centre of growth of the original temple town to maximum towards the north that is Patia, Chandrasekharpur, Raghunathpur, Barang. West wards Khandagiri, Dumduma, Khordha. Eastwards Bhubaneswar-Cuttack Road, Phulnakhara, Pahala. And south towards Puri bypass, Tanka pani, Uttara, so the city spreads to south west Khordha, north east Cuttack- Bhubaneswar highway and east Puri.

And besides having flood plain of Daya and Kuakhai the sprawl is expanding, for example Hitech medical college and its nearby settlements.

Sishupalgarh and Lingipur are also emerging settlements on the flood plain of Daya River.

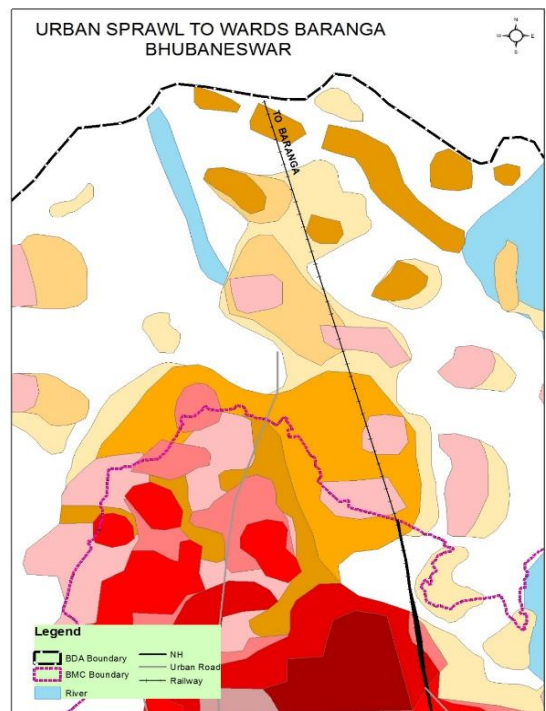


Fig.12

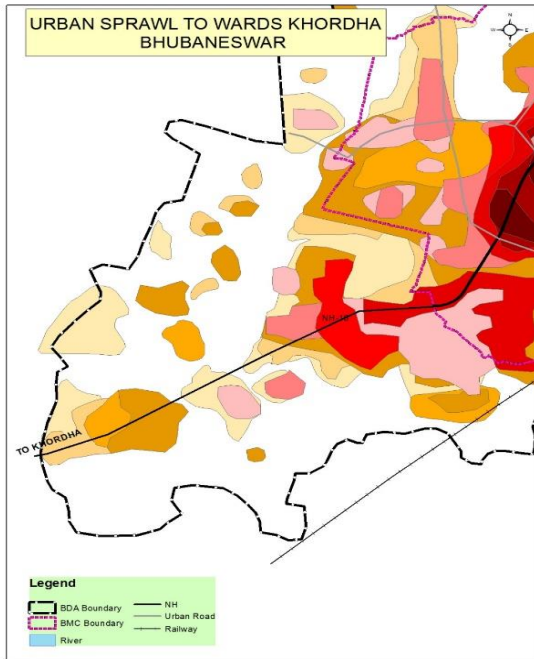


Fig.13

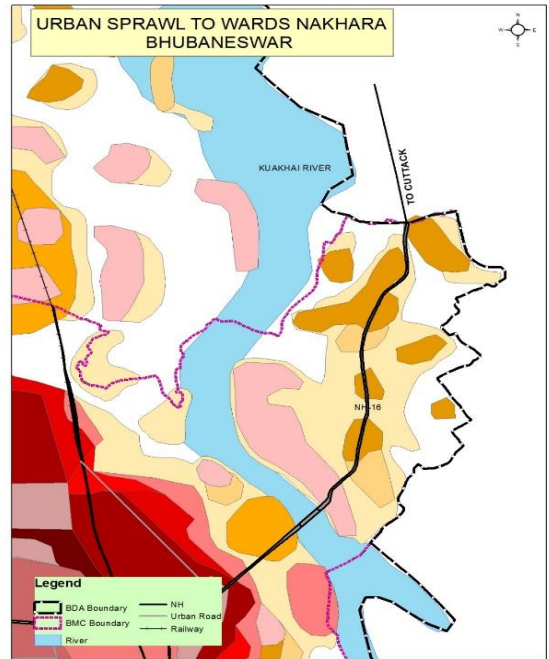


Fig.15

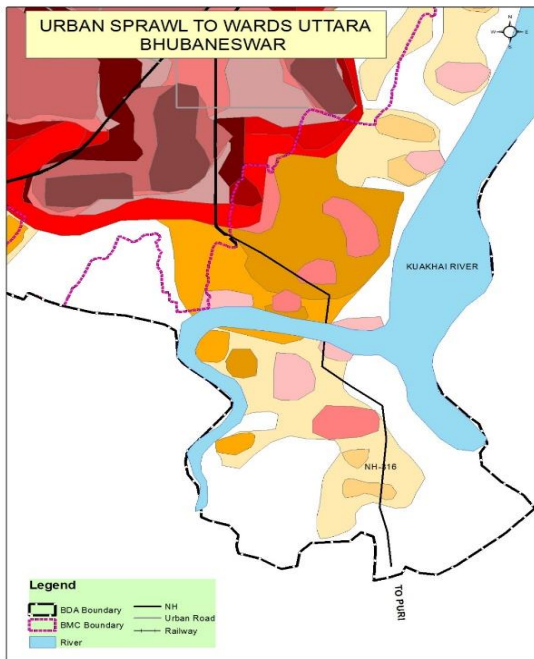


Fig.14

Vision 2030 Comprehensive Development Plan:

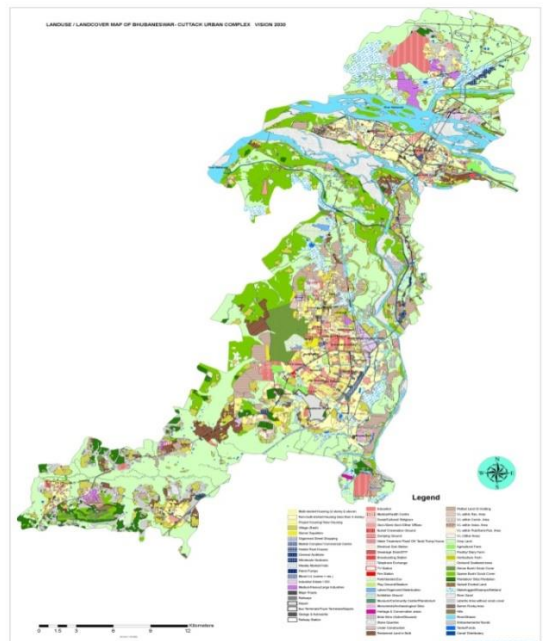


Fig.16

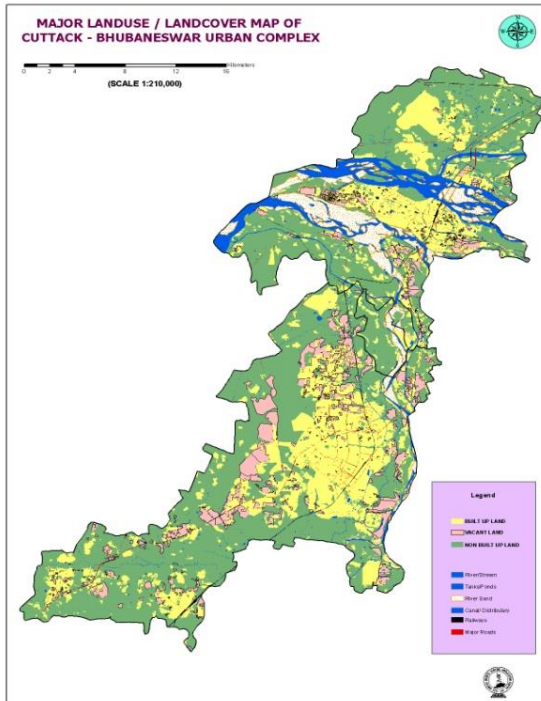


Fig.17

The comprehensive Development Plan for 2030 has been prepared by the IIT Kharagpur indicates there will be a Urban Complex very soon taking the millinium City Cuttack, Capital City Bhubaneswar Sub urban towns like Pipili, Khurda, Phulnakhara and Barang .Most of the agricultural land has been and going to be changed in to the commercial and residential land use From the above map it shows the development has been taken place both the sides of National Highways, major roads, and railway lines. The core area of both the cities have been saturated with major functional zones. Now the growth mostly towards the peripheral zones due to the rapid growth of population and demand of the residential use. In the southern part, drastically growth has been predicted in terms of construction of more built-up lands such as educational institute, health facilities and other. The barren lands and vacant lands in both road banks will be utilized in this conversion process.

The ward no (55-59) shall be worst witnessed it. On the other hand, in the south-west direction of BMC, there is a potential growth of urbanization and ward no-15, 24, 25 will go through the transformation process. The Vegetative cover of Chandaka region may be affected based on the current prediction, thus rigid law is needed to address such issues. There is a spontaneous growth of new commercial buildings, market complex and other institutions along the road side of Bhubaneswar to Jatani via Sunderpada region. It is also predicted that the buffer zone of National Highway connecting Bhubaneswar to Cuttack is going to be heavily populated with concrete jungle due to the conversion of existing open and barren lands. The river banks of the twin city need to be protected as there is a prediction of settlement growth in the private lands available. It is also analysed that the buffer zone of Nandankan Zoological Park is also going to be heavily populated due to the urban sprawl. There is also settlement growth is predicted along the fringe region of railway line, drainage, canals and nalas in the study area.

Policies and planning for effective management:

It has long been recognized that expansive urban and sub-urban growth patterns have detrimental effects on the urban environment and aesthetics, including water and air pollution, inequality, numerous social and economic problems, and expensive infrastructure costs. A peaceful and upbeat atmosphere is lost from city life as a result of this process, which decreases the efficiency and usage of the land area. So, sensible regulations and practical techniques will control the spread of sprawl. The way we move about, what we consume, how we make things, how we power our homes and offices, how we use public areas, and how we handle garbage are all being changed by climate change. A paradigm change is required, and how things are done now must consider future effects. Bhubaneswar is more susceptible to climate change,

and unless it quickly adopts water-sensitive urban design techniques, it won't be able to avoid future catastrophes. Smart urban planning is required, in line with the present global trend. One method of guaranteeing the continued increase of green areas in Bhubaneswar and strengthening a city's resistance to the effects of climate change is integrated smart urban management.

urban system brought on by urban sprawl, the smart growth approach is focused on building more vibrant, competitive, and livable cities. For cities to assure planned urban expansion, it comprises the following smart growth philosophy.

The comparison between smart expansion and sprawl growth to create a resilient and sustainable city is shown in the table below.

In order to combat the degeneration and decay in the

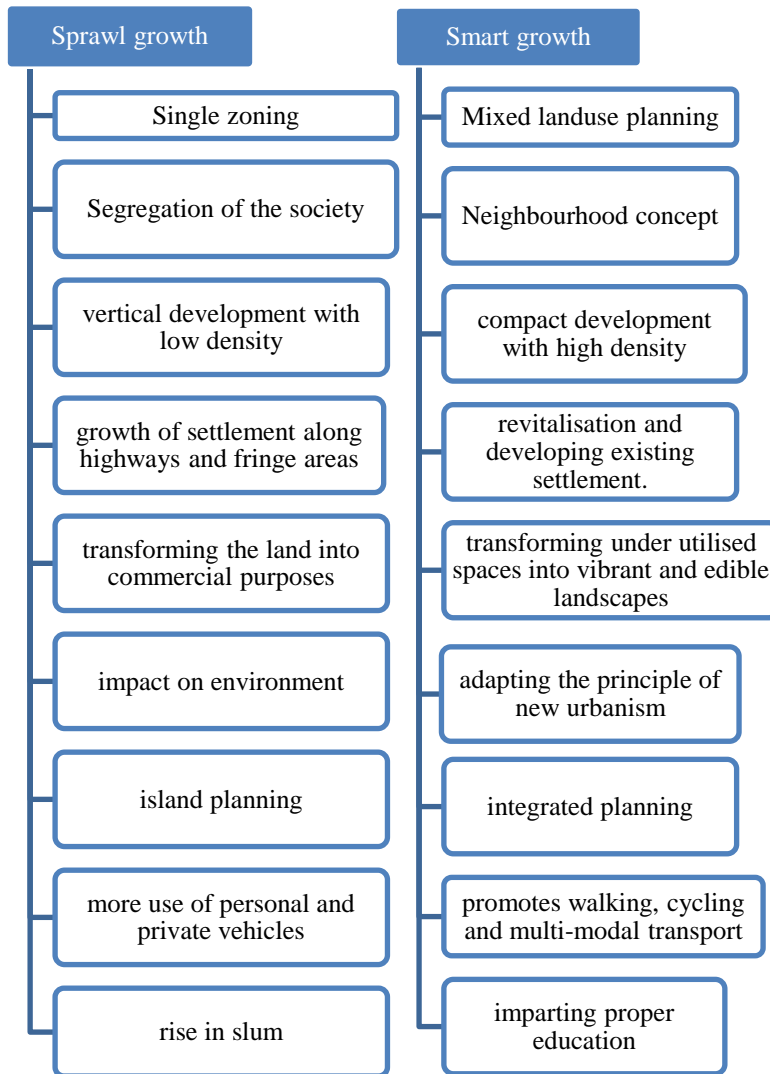


Fig.18

Conclusion

The urban population of Bhubaneswar increased between 1951 and 2019, and the problem has gotten worse since there is not a citywide plan for land use, which has pushed urbanization all the way down to the flood plains. Despite being a planned city, Bhubaneswar has been losing its traits and significance as a result of unplanned, unregulated, chaotic growth both inside the city and on its outskirts. The city's ability to care for the enormous population and uncontrolled mushrooming of settlements has been exceeded in the outer area, resulting in increased trash creation, energy use, and water use. The risk for towns and low-lying regions has grown due to the expansion and blocking of natural drainage routes. The ecology is subsequently disrupted as a result of the extensive and quick land use changes. construction of infrastructure and encroachment into agricultural and forest areas. By limiting groundwater outflow, urban built-up regions' growing densities seriously harm subterranean water resources. Slums are now widely spread around the city, sometimes next to railway lines, drainage systems, and other ecologically hazardous construction. Social, economic, and environmental inequalities all rise as a result of this growth.

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Rights of Urban Working Women: A Review of Legal Provisions in India

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Abstract

Legal instruments and frameworks at national and international level are very important for ensuring gender equality at work place and economic empowerment of women. This will also greatly support in achieving overall economic growth and social justice as the share of women amongst workers in various sectors is significantly high. Women workers account for about one third of all workers in India. There also exist good number of legal instruments and frameworks in developed countries as well as in India. However, no country has so far achieved gender equality, not even among the highest-income countries in the Group of 7 (G7). The reasons behind this may be the legal provisions needing re-evaluation and amendments to encompass the diversified dimensions of women issues based on actual situations. Further a major obstacle preventing women workers from exercising their rights is a lack of awareness of their existence. Dissemination of information about these rights is, therefore, a vital instrument for improving gender equality. This paper reviews and analyzes the existing legal provisions in India, which ensure the rights of urban working women.

Introduction

Legal instruments and frameworks at national and international level are very important for ensuring gender equality at work place and economic empowerment of women. This will also greatly

support in achieving overall economic growth and social justice as the share of women amongst workers in various sectors is significantly high (Table 1). In this context several organizations and initiatives exist internationally. The primary objective of International Labour Organization (ILO) is to ensure standards for improved working and living conditions of working women and men. However, there still exists a large gap between the rights set out in national and international level and the actual situation of workers. Also there exists a great discrimination in rights of working persons based on gender. In order to ensure equity in working environment, the envisaged rights must be made effective in practice as well as new legal instruments need to be developed for working women.

The year 1995 is a remarkable year for the women. On 15th September 1995, the 'Beijing Declaration' was adopted by the United Nations at the end of the Fourth World Conference on Women in order to formulate a set of principles concerning the equality of men and women. Since 1995, equality between men and women in the world of work had seen some encouraging improvements, but these achievements have remained modest. The year 2020 was remarkable for the leaders and activists working for women rights due to 25th anniversary of 'Beijing Declaration'. However, COVID-19 pandemic had eroded this momentum by creating several issues for

working women like severe hardship situations, higher rates of poverty and job loss, increased unpaid care work, and greater exposure to discrimination and violence. In this context the

Table 1 describes the sector wise global share of women amongst workers at risk and impact of COVID-19 crisis on economic output.

Table-1: Sector wise Share of Women amongst Workers at Risk

Sl	Sectors of Risk Work	Share of Women in %	Impact of COVID Crisis on Economic Output
1	Human health and social work activities	70.4	Low
2	Education	61.8	Low
3	Arts, entertainment and recreation and other services	57.2	Medium-High
4	Accommodation and food services	54.1	High
5	Financial and insurance activities	47.1	Medium
6	Wholesale and retail trade, repair of motor vehicles and motorcycles	43.6	High
7	Manufacturing	38.7	High
8	Real estate, business and administrative activities	38.2	High
9	Agriculture, forestry and fishing	37.1	Low-Medium
10	Public administrative and defense, compulsory social security	31.5	Low
11	Utilities	18.8	Low
12	Mining and quarrying	15.1	Medium
13	Transport, storage and communication	14.3	Medium-High
14	Construction	07.3	Medium

Source: Authors based on ILO Monitor: COVID-19 and the world of work. Second Edition (7 April, 2020) International Labour Organization 2021, Empowering Women at Work: Government Laws and Policies for Gender Equality

International Initiatives

A good and justified working environment for women not only supports fight against poverty but also ensures achieving education equality, peace, safety, food security, improved health conditions and social justice. However, women working in the same occupation are systematically paid less than men, even if their educational levels equal or exceed those of their male counterparts. A significant proportion of the gender pay gap across regions remains unexplained, particularly in high-income countries. In this regard some major initiatives for

developing policy and legal frameworks at international level have been discussed below.

In 1995, the Fourth World Conference on Women adopted the 'Beijing Declaration (BDPfA)', a comprehensive and visionary international agenda for women's empowerment. This was perhaps the first consolidated attempt of key legal and policy innovations that would ensure equality of rights between men and women. The BDPfA addresses twelve critical areas of concern requiring specific action to ensure the advancement of women, which

include (1) Women and poverty, (2) Education and training of women, (3) Women and health, (4) Violence against women, (5) Women and armed conflict, (6) Women and the economy, (7) Women in power and decision-making, (8) Institutional mechanisms for the advancement of women, (9) Human rights of women, (10) Women and the media, (11) Women and the environment and (12) The girl child.

The ILO Declaration on Fundamental Principles and Rights at Work, adopted in 1998, advises member States to respect and promote principles and rights in four categories, whether or not they have ratified the relevant Conventions. These categories are freedom of association and the effective recognition of the right to collective bargaining; the elimination of forced or compulsory labour, and the abolition of child labour; equal remuneration of women and men for work of equal value; and the elimination of discrimination in respect of employment and occupation.

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal mandate of actions to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. The 17 SDGs are integrated—they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability. Gender equality and women's empowerment are integral to the achievement of all 17 Goals. However, the SDG 5 describes specially on achieving gender equality and empowering all women and girls.

The Equal Pay International Coalition (EPIC) is an initiative driven by stakeholders committed to reducing the gender pay gap and making equal pay for work of equal value a reality across all countries and sectors. Led by the ILO, UN Women and the

Organization for Economic Cooperation and Development (OECD), the Coalition engages with governments, employers, workers and their organizations, the private sector, civil society and academia to accelerate the closing of the gender pay gap and the achievement of pay equity. EPIC provides a platform for member governments to share information on legislation and proactive measures to address the gender pay gap; to exchange methodologies, analysis and tools for measuring the gender wage gap, and to join a network of organizations and policymakers committed to gender equality in the world of work.

In 2019, the UN General Assembly (UNGA) established International Equal Pay Day (IEPD), to be commemorated on 18 September annually. Its first celebration took place in 2020. The UNGA voiced deep concern over the slowness of progress in women's economic empowerment, the undervaluing of work traditionally done by women, and the difficulties in tackling pay inequality. The UNGA urged action to reach the goal of equal pay for work of equal value for all, and encouraged all stakeholders to continue to support the goal of equal pay for work of equal value.

In June 2019, the International Labour Conference adopted the ILO Centenary Declaration for the Future of Work. The Declaration calls for the achievement of “gender equality at work through a transformative agenda, with regular evaluation of progress made, which (1) ensures equal opportunities, equal participation and equal treatment, including equal remuneration for women and men for work of equal value; (2) enables a more balanced sharing of family responsibilities; (3) provides scope for achieving better work–life balance by enabling workers and employers to agree on solutions, including on working time, that consider their respective needs and benefits; and (4) promotes investment in the care economy”.

The international Group of Seven is an intergovernmental political forum consisting of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States; additionally, the European Union is a "non-enumerated member". The G7 and the EU have fostered ongoing dialogue, often tripartite, adopted policy frameworks and issued calls to action to accelerate progress towards gender equality in the world of work. The Gender Equality Advisory Council (GEAC) was established in 2018 by Canada, the G7 Presidency of that year, as an external advisory body to provide recommendations on gender equality to G7 leaders. However, no country has so far achieved gender equality, not even among the highest-income countries in the Group of 7 (G7). But, attempts are

going on to develop and implement legal instruments and frameworks for working women in developing countries. The various aspects covered under such attempts include:

- Equal pay for work of equal value
- Ending violence and harassment in the world of work
- Promoting work–life balance
- Women in decision-making in the world of work
- Building a future of work that works for women

An analysis of legal instruments and frameworks in existence in G7 countries have been presented in Table 2.

Table-2: Legal instruments and Frameworks in existence in G7 countries

Sl	Aspect	Canada	France	Germany	Italy	Japan	UK	US
1	Employer mandated to take steps to prevent or protect against sexual harassment	Yes	Yes	Yes	No	Yes	Yes	No
2	Employer Mandated to have a Sexual Harassment Policy	Yes	No	No	No	No	No	No
3	Employer mandated to have Internal Complaints Mechanism	Yes	Yes	Yes	No	No	No	No
4	National Policy on Violence/ GBV	Yes <i>Workplace mentioned</i>	Yes <i>Workplace mentioned</i>	Yes <i>Workplace mentioned</i>	Yes <i>Workplace not mentioned</i>	Yes <i>Workplace mentioned</i>	Yes <i>Workplace mentioned</i>	No
5	Existence of Domestic Violence Regulation	Yes	Yes	No	Yes	Yes	Yes	Yes
6	Legal Right to Breast Feeding Arrangement at Work Place	No	Yes	Yes	Yes	Yes	No	Yes
7	Regulatory provisions for violence against night, isolated or migrant workers	No	No	No	No	Yes <i>Night Workers</i>	No	Yes <i>Night Workers</i>
8	Employer mandated to train managers, supervisors or employees on physical and psychosocial violence risks	Yes	No	No	No	No	Yes	No
9	Employer mandated to prevent Domestic Violence in the workplace/ protect against Domestic Violence	Yes	No	No	No	No	No	No

Source: Compiled from ILO, 2021, *Empowering Women at Work: Government Laws and Policies for Gender Equality*

Legal Provisions in India

Women workers account for about one third of all workers in India. There are various issues which a woman deals with during her entire life span. Gender specific crimes identified under the Indian Penal Code (IPC) include:

- Rape, including custodial rape.
- Kidnapping, importation of girls, selling minors for the purpose of prostitution abduction for different purposes, abducting or inducing woman to compel her marriage
- Dowry deaths,
- Cruelty within the marital home.
- Molestation and outraging the modesty of a woman.
- Causing miscarriage
- Provisions relating to obscenity.

But the concerns which specifically arise at workplace mainly involves -

- Gender discrimination in terms of opportunities, promotions, and remunerations.
- Sexual Harassments or sexual assaults.
- Pregnancy discrimination or maternity problems.

The Sexual harassment at workplace broadly includes physical contact or advances;, demand or request for sexual favours; making sexually colored remarks; showing pornography; any other unwelcome physical, verbal or non-verbal conduct of sexual nature.

The Constitution of India recognizes equality rights of women in various Articles as described below and allows the state to take special measures for women and children to realize the guarantee of equality.

- Article 14 - Men and women to have equal rights and opportunities in the political, economic and social spheres.

- Article 15(1) - Prohibits discrimination against any citizen on the grounds of religion, race, caste, sex etc.
- Article 15(3) - Special provision enabling the State to make affirmative discriminations in favour of women.
- Article 16 - Equality of opportunities in matter of public appointments for all citizens.
- Article 39(a) - The State shall direct its policy towards securing all citizens men and women, equally, the right to means of livelihood.
- Article 39(d) – Equal pay for equal work for both men and women.
- Article 39(e) – State is required to ensure that health and strength of women workers are not abused and that they are not forced by economic necessity to enter avocations unsuited to their strength.
- Article 42 - The State to make provision for ensuring just and humane conditions of work and maternity relief.
- Article 51 (A)(e) –To renounce the practices derogatory to the dignity of women.
- Article 243 (D 3 & 4) (T 3 & 4) - One third of the total number of seats and chairpersons to be filled by direct election in every panchayat/ municipality shall be reserved for women.

There are various legal instruments that exist for ensuring rights of women in India. These legal provisions also apply to the rights of working women in special. They have been described below:

- Hindu Marriage Act of 1955 amended in 1976 provides the right for girls to repudiate a child marriage before attaining maturity whether the marriage has been consummated or not.
- The Marriage (Amendment) Act, 2001 amended the Hindu Marriage Act, Special Marriage Act, Parsi Marriage and Divorce Act, the Code of Criminal Procedure providing for speedy disposal of applications for maintenance; the ceiling limit for claiming

maintenance has been deleted and a wide discretion has been given to the Magistrate to award appropriate maintenance.

- The Immoral Traffic (Prevention) Act of 1956 as amended and renamed in 1986 makes the sexual exploitation of male or female, a cognizable offence. It is being amended to decriminalize the prostitutes and make the laws more stringent against traffickers.
- Dowry Prohibition Act of 1961 and an amendment brought in 1984 ensures women's subjection to cruelty a cognizable offence. The second amendment brought in 1986 makes the husband or in-laws punishable, if a woman commits suicide within 7 years of her marriage and it has been proved that she has been subjected to cruelty. Also a new criminal offence of 'Dowry Death' has been incorporated in the Indian Penal Code.
- Child Marriage Restraint Act of 1976 raises the age for marriage of a girl to 18 years from 15 years and that of a boy to 21 years and makes offences under this Act cognizable.
- Medical Termination Pregnancy Act of 1971 legalises abortion by qualified professional on humanitarian or medical grounds. The maximum punishment may go upto life imprisonment. The Act has further been amended specifying the place and persons authorized to perform abortion and provide for penal actions against the unauthorized persons performing abortions.
- Indecent Representation of Women (Prohibition) Act of 1986 and the Commission of Sati (Prevention) Act, 1987 have been enacted to protect the dignity of women and prevent violence against them as well as their exploitation.
- The Protection of Women from Domestic Violence Act, 2005 provides for more effective protection of the rights of women guaranteed under the Constitution who are victims of

violence of any kind occurring within the family and for matters connected therewith or incidental thereto. It provides for immediate and emergent relief to women in situations of violence of any kind in the home.

- Pre-conception and Pre-natal Diagnostic Technique Act, 1994

However, there also exist some specific legal provisions for working women in India. They have been described below:

- Labour statutes such as-
 - Equal Remuneration Act, 1976, provides for equal pay to men and women for equal work.
 - Minimum Wages Act 1948
 - Factories Act 1948
 - Workmen's Compensation Act, 1923
 - Maternity Benefit Act (1961)
 - Contract Labour (Regulation and Abolition) Act 1970
 - The Mines Act 1952
 - The Plantation Labour Act 1952
 - Building and Other Construction Workers Regulation of Employment and Conditions of Service Act 1996
 - The Beedi and cigar Workers (Condition of Employment) Act, 1966
- The prohibition of Sexual Harassment of women at Workplace Act, 2013 enacted to help women get a safe and secure working environment. Other laws which includes regulations in relation to sexual harassment at workplace are:
 - Industrial Employment (standing orders) Act, 1946
 - Indian Penal Code, 1860
 - Indecent Representation of Women (Prohibition) Act of 1986
- National Commission for Women's Act (1990)
- Criminal and civil procedural laws- such as Code of Criminal Procedure (1973), Code of

Civil Procedure (1908), Indian Evidence Act (1872).

- Legal Services Authorities Act, 1987.
- Personal laws on marriage, property rights, guardianship and custody rights, maintenance.
- Supreme Court guidelines on the prevention of sexual harassment at the workplace. (1997)
- Supreme Court guidelines on the compulsory registration of marriages.

Apart from all these above described legal provisions, some new developments have also taken place in India as described below:

- Criminal Law Amendment Act, 2013 included the following:
 - Section 354 A, B, C, D provides for Sexual harassment, assault, voyeurism, stalking and punishment for these.
 - Section 376 provides amended definition of Rape and inclusion of 'Digital rape'.
- The Muslim Women (Protection of Rights on Marriage) Bill 2017 makes instant 'Triple Talaq' in any form illegal and void.
- Unorganized Sector Workers Bill in process.

Some important rights of women as per various Indian laws, which every working woman should know are given below:

- Right to Free Aid: When a woman goes to the police station without accompanied by a lawyer, she has a right to get legal aid and she should demand it.
- Right to Privacy: A rape victim woman has a right to record her statement in private in front of the magistrate without being overheard by anyone else.
- Right to Zero FIR: A rape victim woman can register her complaint from any police station under Zero FIR.
- Right to No Arrest: An woman cannot be arrested after sunset and before sunrise.

- Right to not being called to the Police Station: As per section 160 of criminal procedure code, women cannot be called to the police station for interrogation.
- Right to Confidentiality: Under no conditions, a rape victim's identity can be revealed. Section 228-A of IPC makes it a punishable offence.

CONCLUSION

Though numerous women specific laws exist internationally as well as in India, the facts and figures represent a devalued status of women, especially in workforce of the country. The reasons behind this may be the legal provisions needing re-evaluation and amendments to encompass the diversified dimensions of women issues based on actual situations. Further a major obstacle preventing women workers from exercising their rights is a lack of awareness of their existence. Dissemination of information about these rights is, therefore, a vital instrument for improving gender equality. In this context, the governments, planners and researchers should review their efforts in developing and evolving new legal provisions and policy frame works focusing achieving equal pay for work of equal value; preventing and eliminating violence and harassment in the world of work; creating a harmonious work-life balance for both women and men and promoting women's equal representation in leadership in the world of work. The employers as well as government and other non-government organizations should also work on developing awareness on various legal provisions amongst their women workers.

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Shifting of Conventional Energy and Adaptation of Renewable Energy in Odisha: A Step Towards Sustainability

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Abstract

One of the most important factors in the growth and well-being of the country's economy is energy. With the decline in conventional resources in recent years, there will be a severe energy shortage worldwide. Global population, economic production, and fossil fuel usage all increased significantly in the 20th century. The globe is exploring alternate energy sources since conventional supplies are becoming scarce. One of the states in India with the highest concentration of minerals in Odisha. It has 26% of India's coal reserves. Most of Odisha's power is produced by coal and mineral oil-based power plants, which significantly increase CO₂ emissions. Fossil fuels are no longer a reliable source to meet increasing energy demands and promote a sustainable future, thus alternative sources are required to fulfil the energy demands by shifting from conventional sources to a renewable source of energy. Access to environmentally clean and renewable energy is critically linked with sustainable development. In order to balance the energy demand and reduce fossil fuels emission the state government has laid focus on carbon-neutral green energy. The present paper analyzed the economic and environmental aspects of green energy development in Odisha. It also examines the effects of renewable energy on the electricity supply system and estimates the CO₂ emission by developing various scenarios. The paper discusses the adoption of green energy technology into the current conventional energy

sector, its challenges, and approaches. The results show that power sector emissions were a major source of emissions from the energy sector contributing to 83% of overall emissions. At present renewable energy accounts for about 11.5% of electricity generation. The paper provides a sustainable solution for meeting energy needs and reducing dependence on conventional sources.

Keywords: Conventional energy sources, Renewable energy, sustainability, solar energy.

Introduction

Energy is one of the most fundamental components of economic growth and the welfare of nations. Most of the power generation is carried out by coal, and mineral oil-based power plants which contribute heavily to greenhouse gas emissions. The world's population, economic production, and use of fossil fuels all increased significantly in the 20th century. The current energy systems are largely dependent on fossil fuels which negatively impact air quality and significantly contribute to carbon emissions. In recent years, the world will face an acute energy scarcity with the reduction in conventional resources. Due to the limitation of conventional resources, the world is looking for an alternative source of energy. Using abundant renewable energy sources wisely, such as biomass, solar, wind, and geothermal energy, is crucial to addressing the world's energy dilemma. The transformation of the global energy systems to reduce carbon dioxide

(CO₂) emissions requires engagement at all socioeconomic levels, including towns, regions, governments, and a wide range of stakeholders in the public and private sectors. By 2030, India has promised to use 40% of its installed capacity for the generation of non-fossil fuel-based energy and to lower its emission intensity by 33 to 35%. Electricity production is India's largest source of emissions, hence reducing the carbon footprint of

this sector is essential. 30% of the installed capacity for power in Odisha is based on non-fossil fuels, while the remaining 70% is dependent on coal. Considering that coal makes up a large portion of the power generating mix and that there are large enterprises (captive powerplants) in Odisha together contribute around 80% of the GHGs emission.

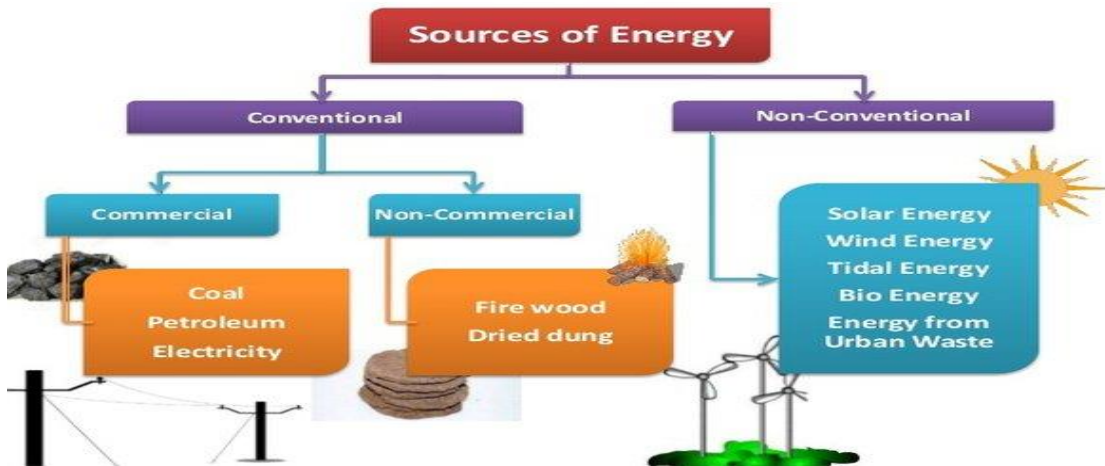


Fig.1

Why renewable energy is relevant for Odisha

Around 65% of the state's power generation capacity comes from coal, which accounts for 20% of all domestic coal production in India. As coal-based generation creates fly ash, carbon, and other pollutants, we must hunt for clean, alternative energy sources. The need for decentralized renewable energy in Odisha is also driven by the state's dispersed rural population, as a result of the state's frequent natural disasters, which can harm infrastructure and the power sector. Because settlements in Odisha tend to be dispersed, a large grid network is also necessary.

Coal and mineral-based power plants, which are a major source of greenhouse gas emissions, produce most of the nation's electricity. Odisha is fortunate to have abundant access to renewable energy,

mostly in the form of solar, wind, and biogas energy. The state's total energy potential is 11,000 MW, with a gross potential of 100 MW. A major renewable energy source solar energy can address many global concerns. Enhancement of its energy market share is warranted for several reasons. This power source is gaining popularity because of its adaptability and many positive effects on both people and the environment. It is a secure alternative source that can reduce the need for the present fossil fuels coal and gas to provide power. As compared to the rest of the state, Odisha's coastal regions see the highest levels of solar radiation. More bright days have been recorded overall. In order to advance solar energy and close the "gap" between energy demand and supply, a better choice must be considered. Because of recent advancements in technology and government initiatives that have

reduced the cost of energy use, solar energy has grown astronomically.

Renewable energy and sustainable development

The key aim of the use of renewable energy in Odisha is to promote economic growth, enhance energy security, increase access to electricity, and lessen climate change. Ensuring that residents have access to reasonably priced, dependable, sustainable, and contemporary energy is necessary for sustainable development.

The state of Odisha has a 485 km long coastline and is located between latitudes 17.31N and 22.31N and 81.31E and 87.29E. According to the 2011 census, the region has a population of 11631959 and a total area of around 22250.29 sq. km. The state has a tropical climate, which is marked by high temperatures, high levels of humidity, moderate to heavy amounts of precipitation, and brief and mild winters.

Database and methodology

The ongoing research has a quantitative approach. Both primary and secondary sources have been used to get the data. The main information has been gathered from several organizations, including OREDA, GEDCOL, and GRIDCO. Published papers, journals, and books have been used to gather secondary data. MS Excel has been used to integrate and tabulate the data acquired. To analyze the data some statistical methods are adopted.

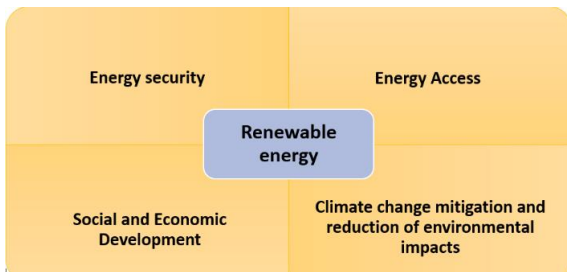


Fig.2

Study area:

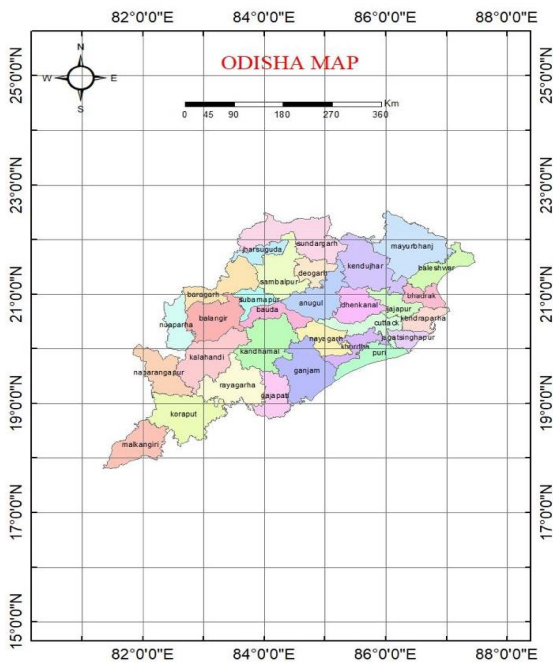


Fig.3

Objectives of the study

1. To analyze the economic and environmental aspects of green energy development in Odisha.
2. To examine the effects of Renewable energy on the electricity supply system and estimate the CO₂ emission by developing various scenarios.
3. To address the challenges faced during the adoption of green energy technology into the conventional energy sector.

Analysis and interpretation:

Power Sector of Odisha

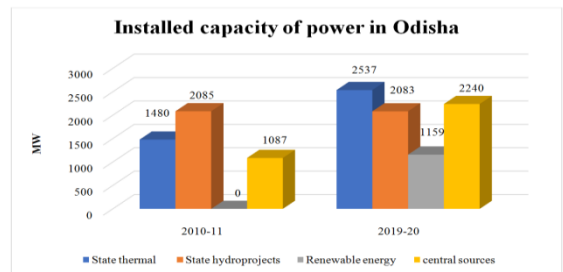


Fig.4

Source: Economic survey report 2019, Odisha

The above figure shows the total installed capacity power of Odisha for the year 2010-11 and 2019-20. In the year 2011 hydro projects accounted for the highest capacity followed by the thermal sector. Whereas at present the thermal sector accounts for the highest capacity of 2537 MW followed by the Hydro projects. The figure shows that the state Renewable Energy in 2011 was very negligible but in 2019 it has an installed capacity of 1159 MW which indicates the rapid growth of renewable energy.

Power consumed by different sectors in Odisha:

Table-1

Sources	2010(MU)	2019(MU)
Domestic	3533	8113
Commercial	1113	2029
Industrial	6755	5529
Agriculture	179	670
Public lighting	58	136

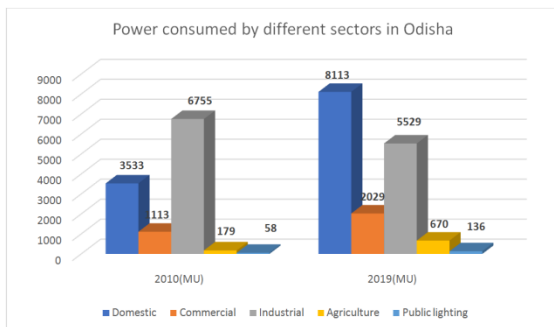


Fig.5

The above figure shows the power consumed by different sectors in Odisha for the years 2010 and 2019. The industrial sector accounted for the highest in the year 2011 followed by the domestic and commercial sectors whereas in 2019 the domestic sector accounted for the highest power consumption this is due to the population growth and increase in

urban settlements and rural electrification, both the demand and consumption of power have increased.

Energy Structure in Odisha:

The electricity sector in Odisha now uses 30% non-fossil fuel capacity, with a large portion coming from hydropower and no nuclear power plants installed. The installed capacity for public usage is made up of roughly 70% coal-based power capacity. Odisha generates over 80% of the state's GHG emissions due to the high proportion of coal in the state's power-generating mix the presence of large businesses and vehicular use. As of October 31, 2019, the state's installed capacity was 8.87 GW (CEA, 2019). The state has Captive Power Plants owned by significant industries, which have an additional capacity of approximately 11 GW. Captive Power Plants are hence the main source of electricity generation in Odisha.

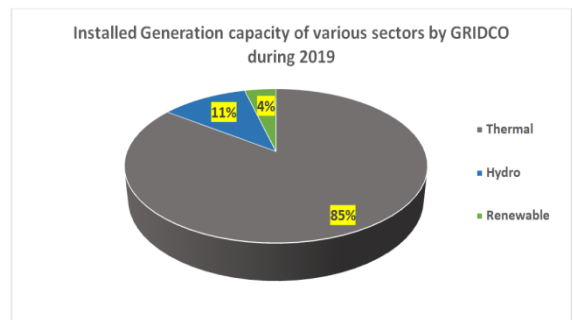


Fig.6

The above figure shows the percentage of total installed generation by various sectors. At present thermal sector accounts for 85% followed by hydro (11%) and renewable energy 4%. Odisha had 18.6 GW of installed capacity in 2018, with 87% coal and 13% renewable energy. The installed capacity has increased seven times from 1995, when it was just 2.8 GW, to 18.6 GW in 2018. The firm capacity is the entire generation capacity that is made available to the utilities for the purpose of producing

energy through long-term relationships. In 2018, Odisha has 5.5 GW of firm capacity available.

Emission estimates:

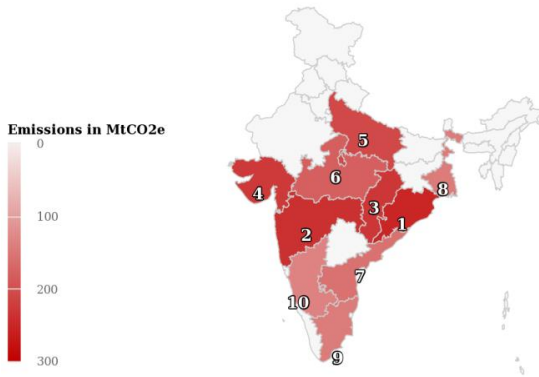


Fig.7

Table-2

Odisha’s total energy emissions of 251.72 Mt CO2e	
Industries	131.69
Captive-power Plants	54.69
Public electricity generation	48.16
Transport	9.17

Source: GHG Platform India

Energy sector emissions assessment considers emissions from fuel combustion and usage in electricity production, captive power plants, industries, transportation, residential, commercial, and agricultural settings. 2018's total energy emissions are categorized by the state in the map above. (GHG platform India. Odisha ranks the highest in energy emissions with a value of 251.72 Mt CO2e.

Contribution of each sector to the total emission of CO₂

Odisha is highly industrialized and endowed with abundant natural resources. In 2015, Odisha was responsible for 7%, or 178 million tonnes of CO₂

(e), of the nation's overall CO₂ (e) emissions (Source: GHG Platform). Power generating for public use in Odisha Use is responsible for around 38% of the emissions from the state's energy industry. Energy emissions in the state are made up of 52% of industry sector emissions, which includes captive power generation in the state. Compared to the national average of 2 tonnes, Odisha has much greater per capita emissions at 4.22 tonnes. Moreover, the state's emission per GSDP is 65.7 gCO₂(e)/INR, significantly higher than the national emission intensity of 23.3 gCO₂(e)/INR.

Table-3

Emission source	CO ₂ Eq (MT)	%
Energy	61,307,420	45
Agriculture	25,067,055	20
Waste	6,59,016	3
Industrial	48,461,456	32

Source: Odisha carbon footprint report 2018

The above table illustrates the total emission from each sector to total CO₂ emission in which the energy sector accounts for 45 followed by the industrial sector at 49% and the agricultural sector at 25%. CO₂, CH₄, and NO₂ are the major greenhouse gases that contribute maximum to total emissions where CO₂ accounts for 72% followed by Methane at 23% while NO₂ contributes 5%.

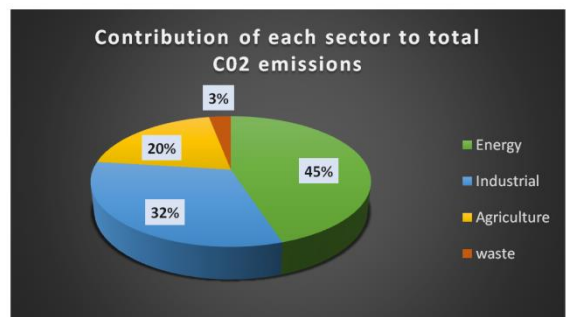


Fig.8

Contribution of the energy sector to the total emission of CO₂

Table-4

Energy emission sources	CO ₂ Eq (MT)	%
Power generation	50,770,105	83
Transport	6,077,759	10
Residential/Commercial	1573,317	3
Other	907,641	1
Fugitive emission	1,978,598	3

The table above shows that the energy industry is the leading source of CO₂ emissions. 83% of these are released during the production of electricity, 10% during transportation, and 3% during residential activity. When fossil fuels are used to provide the heat required to run steam turbines, over 80% of the CO₂ emissions are produced during the electricity production process. Burning these fuels produces carbon dioxide (CO₂), the main heat-trapping greenhouse gas linked to global warming, hence using smart electric grid technology is essential to lowering CO₂ emissions. In order to reduce CO₂ emissions, it is also imperative that renewable energy be promoted across all consumer sectors.

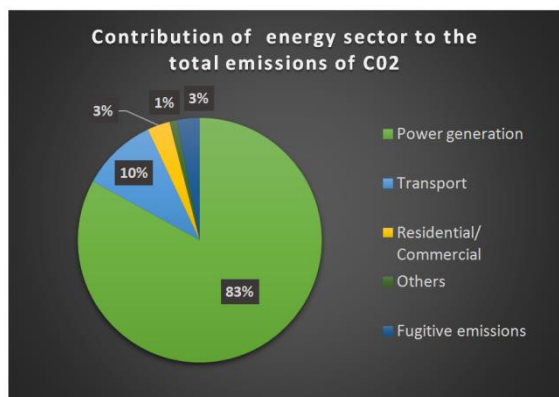


Fig.9

Source-wise green energy potential of the state:

Table-5

Source	Wind power	Small-hydro power	Biomass power	Waste energy	Solar energy	Total
Value (MW)	8346	286	246	22	25780	34680

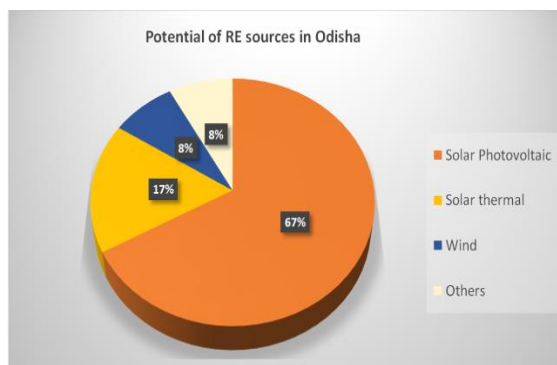


Fig.10

The potential for renewable energy in Odisha is enormous and mostly unrealized. Yet, it is necessary to determine the technological viability so that the right technology may be used to unlock a significant portion of the potential. Sustainable development is being made possible by renewable energy, which is becoming economically viable, moving in the direction of minimal carbon emissions.

The state's source-wise potential for green energy is depicted in the above graphic. There is a total of 34,680 MW of potential energy, of which 25,780 MW is generated by solar energy, followed by wind energy (8346 MW) and modest hydropower (246 MW). The state has a considerable energy potential, mostly in the form of solar energy, which is followed by wind and biomass energy. The total gross potential of the state is 53,000 MW of which only 11,000 MW is feasible.

Installed capacity of electricity generation in GW

Table-6

Source	Hydro	Thermal	Nuclear	Res	Total
Value (GW)	2.06	5.54	-	0.54	8.14

The above table shows the total installed capacity of electricity generation from different sources of which thermal accounts for 68%, followed by hydro at 25% and Renewable energy is 7%.

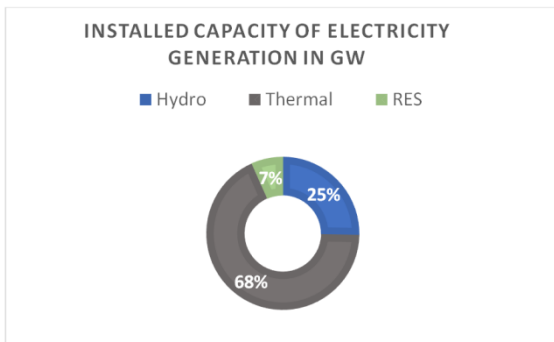


Fig.11

Installed capacity of Grid Interactive Renewables power

Table-7

Source	Small hydro power	Wind power	Biopower	Waste to Energy	Solar power	Total capacity
Value (MW)	88.63	-	59.22	-	401.72	549.57

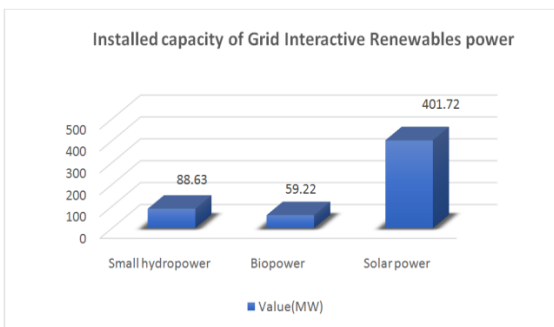


Fig.12

5.10 Scenario of Solar Energy in Odisha

Table-8

Year	Installed capacity (MW)
2016	66.92
2017	79.42
2018	79.57
2019	394.73

Source: MNRE report

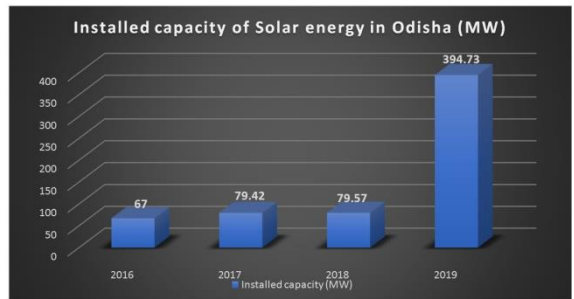


Fig.13

Solar energy is the energy from the sun that is converted into thermal and electrical energy. Solar power is a clean renewable resource with zero emissions and has got enormous potential for energy that can be harnessed using a variety of devices with recent developments, solar energy is easily available for industrial and domestic purposes. The above figure illustrates the installed capacity of solar energy in Odisha. At present, the total installed capacity is 394 MW. Odisha receives average solar radiation of 5.5kWh/m² with a capacity utilization factor of range 15-17% and 300 clear sunny days each year. As per the MNRE report, the solar potential of the state is 26 GWp.

5.11 Renewable energy present status

Odisha framed the RE policy in the year 2016. As per the RE policy 2016 a target of 2,750 MW was set to be installed out of which only 617 MW has been installed. The Renewable Purchase Obligation (RPO) target for Odisha is 11.5% and it will increase to 43% by 2030.

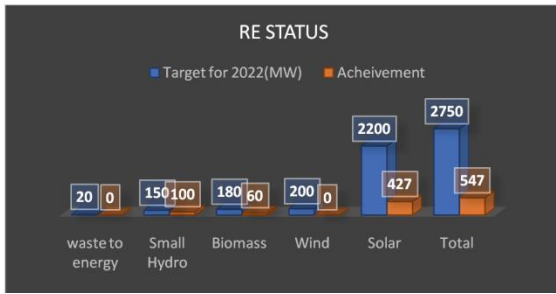


Fig.14

6. Challenges faced during the adaptation of renewable energy:

Limited domestic fossil fuel resources, high dependence on fossil fuel imports and the need to limit carbon emissions have driven the search for alternative energy sources. Renewable energy, especially decentralised renewable energy technologies have the potential to meet electric, thermal, mechanical energy needs of not only households but also a number of community services and livelihoods.

The three principal challenges faced:

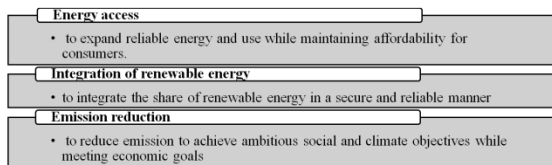


Fig.15

It is suggested that the green energy potential to be fully used the application process and devices must be brought into main stream through intensive governmental efforts. Another aspect of integrating Renewable energy to tap the employment potential.

7. Conclusion:

The economic and social development of any country depends on its energy availability. The present potential of renewable energy is 34,680MW. This evaluation has proved that these sources have massive potential to accomplish the present energy demand. As per the RE policy 2016, the state is

falling short of its own target by 56%. The govt. should develop and implement RE technologies and go for sustainable energy management. The current situation of harnessing energy requires adjusting for the integration of RE into transportation and electricity generation for sustainable development. Integration of Renewable energy with rural development and rural livelihoods enhances the local quality of life and improves income. To opt for mindful and deliberate utilization instead of mindless and destructive consumption of resources to save the earth from the disastrous consequences of climate change. Access to energy, especially renewable energy must be an integral part of state development programs.

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Adoption of New Dimensions in Agriculture and Food Security With Special Reference to Jashpur District

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Abstract

With the implementation of Green Revolution in the 1960s Indian Agriculture has seen many reforms and developments in terms of land reforms, improved seeds, chemical fertilizers, pesticides. The crux of agricultural development is ever evolving technology and innovations; but its adoption depends on information, access, affordability and applicability. The implementation of new technologies and machinery has not only raised the productivity but have also facilitated in the spread of agriculture but still there are regions and population in need of food aids for their sustainment. Present study attempts to recognize the adoption of new dimensions in agriculture and its relationship with food security with Jashpur district as a sample unit.

Keywords: Agricultural Adoption, Food Security, Hunger Index, Jashpur District.

Introduction

Adoption in agrarian context refers to the process by which a new idea or technology is implemented in practice by the farmers with the sole purpose of increasing the quality and quantity of their produces. For increase in production and productivity, a type of system has been created where by the help of agricultural new dimension, methods, investment and scientific institutions formed and the techniques are applied in it; that can be termed as development (S.K. Sharma, 1988). Three-fourth part of the

population in the world live in rural areas and their primary livelihood is agriculture. Hunger and child malnutrition is more seen in rural areas as compared to the urban areas. Keeping these facts in mind, the new agricultural dimension, food security and hunger are the important aspects in the Jashpur district of Chhattisgarh.

New Dimensions of Agriculture

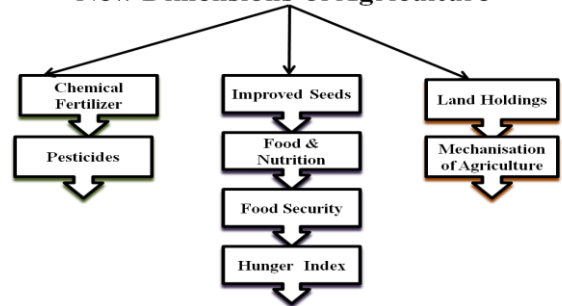


Fig.1

Objectives

1. To study the indulgence in modern Dimensions of Agriculture in the study area.
2. To analyze the Food Availability and Food Security Conditions in Monetary Value through the evaluation of Food Production by Tribal farmers.
3. To derive the Hunger Index for the sample population.

Sources of Data and Methodology

Present study is based on primary and secondary data. From each of the 8 development blocks

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of the district two villages are selected on the basis of purposive methods and so, in all 16 sample villages are selected for detailed survey. The Primary data is collected through Schedule Survey of the heads of the 465 households. The Secondary data was collected from Land Records and Dy. Director, and presented in the form of tables, maps and diagrams. For the Cartographic representations Arc GIS Version 10.3 has been employed.

Study Area

Jashpur district is situated in the north-eastern part of Chhattisgarh. It's Latitudinal extent is from 22°16' to 23°15' N and Longitudinal extend is from 83°23' to 84° 08' E. The Total Geographical Area of Jashpur district is 6,088 sq.km. and total population is 8,52,042 person in the 2011 Census of India Survey. The district has four types of soil -Clay, Loamy, Yellow Loamy and Red soil; and is drained by Ib and Shankh of the Mahanadi system and Kanhar of Lower Ganga system.

Agricultural Adoption

Agricultural Adoption is the application of scientific research and new knowledge to agricultural practices through farmer education. The use of new technologies with their detailed information by the farmers as per their potential is Adoption, (Feder & Others, 1985). Adoption is a decision of full use of an innovation as the best course of action available, (Rogers, 2003). The process of accepting innovations by society and individuals for prolonged time span is known as Adoption. The long term

continuous usage of recommended thoughts, methods and investments; both individually and by society is known as Adoption, (Dasgupta, 1989). In agriculture, adoption is focused on Green Revolution technologies such as irrigation, fertilizer use and high-yield variety (HYV) seeds. Apart from the Technology Adoption; Agricultural Adoption depends on Farm Size, Human Capital (Education, Health, Age, Gender, etc), Labour Availability, Tenure and Commodity Market Access.

To determine the Index of Adoption in the study area we have selected ten variables and employed the following formula-

$$IA = LQs/n * 100$$

$$LQs = V1E + V2E + \dots + VNE / V1R + V2R + \dots + VNR$$

Where,

E= value of indicator in blocks

R= value of indicator in district

V1 = % of NSA from TGA

V2= % of DCA from TCA

V3= % of GIA from TCA

V4= % of area under HYVs from TCA

V5= Usage of Pesticides per TCA

V6= Usage of Fertilizers per TCA

V7= Number of Oil Engine per HA

V8= Number of Electric Engine per HA

V9= Number of Tractor per HA

V10= No. of Plant Protection Equipments per HA

Table 1: District Jashpur: Index of Adoption

Block	Pathalgaon	Pharsabahar	Bagicha	Jashpur	Duldula	Manora	Kunkuri	Kansabel	Average
Index of Adoption	2.2	1.46	1.6	1.36	1.29	1.31	1.93	1.64	1.6

Source- Computed by Researcher

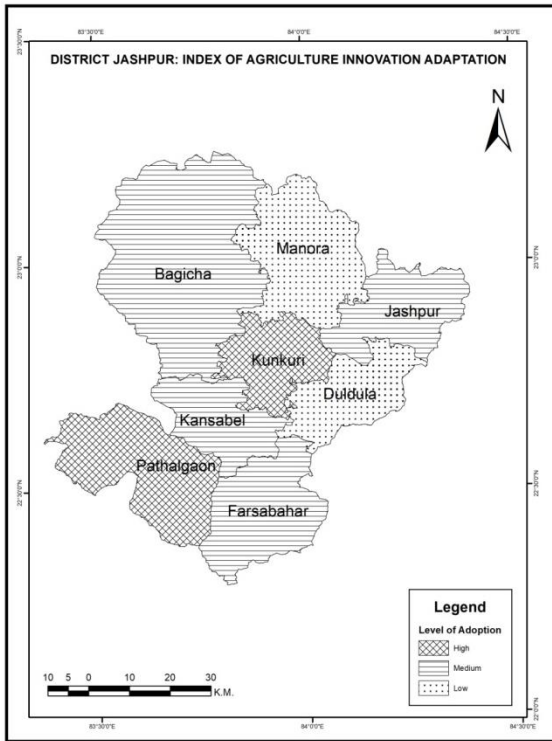


Fig. 2

Jashpur district shows an average 1.6 Index of Adoption, where Pathalgaon shows the highest value of 2.2 and Duldula Blocks the lowest value of 1.31. For the sample villages Composite Z-Score Value has been calculated to determine the Agricultural Adoption and plough, Udavani Pankha, Spray Pump, Diesel Pump, Electric Pump, Tractor, Manure and Chemical Fertilizer have been considered as variables. This is because the sample villages represent only a selected portion of the village; thus many of the variables which were employed for the district are not applicable here. Sample village Barjor has the highest Composite Z-Score Value of +5.86 Jamchuwa the lowest of -7.19.

The Sample Villages have been categorized into six levels according to their obtained index of Agricultural adoption. Sample villages Barjor and Chiknipani which constitutes the highest zone fall in

the Plateau region of the District which not only has the plain level terrain but also is irrigated by Maini and other tributaries of Ib river. Whereas, the sample villages with the lowest Agricultural Adoption have dense forest coverage and resultant the tribals follow traditional agriculture with minimal irrigation on coarse mountain soil. In these villages there is barely any usage of technologies for agriculture.

Table 2: District Jashpur: Agricultural Adoption in Sample Villages

Level	Range	Sample villages
Very high	Above 5	Barjor, Chiknipani
High	From 2.5 to 5	Semarkachhar, Mundadih, Bemtatoli
Moderately Positive	From 0 to 2.5	Ghoghar, Kukurbhuka, Basen
Moderately Negative	From 0 to -2.5	Haldimunda, Tempu, Patwakona
Low	From -2.5 to -5	Ambachuwa, Gamaharia, Baighma
Very low	Below -5	Sakardih, Jamchuwa

Source- Computed by Researcher

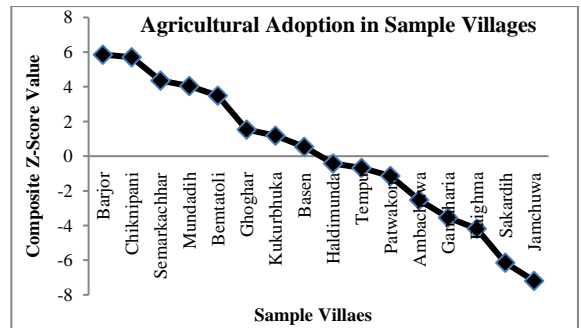


Fig. 3

Food Security

The term Food Security was first used at the World Food Conference, 1974. it was defined as the "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices". FAO (1984)

has defined “Food security as a situation in which all people at all time have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. Thus, Food security is a condition related to the supply of food, and individuals' access to it. Food security is a crucial aspect of life with a complex, multidimensional and complicated concept.

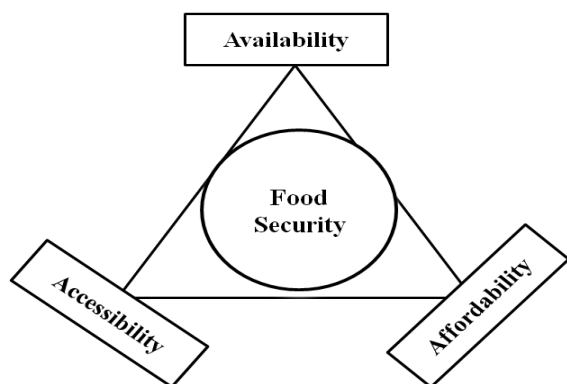


Fig.4: Major Aspects of Food Security

It has been visualized at and international, national, regional, household even at individual level. FAO, has identified the four pillars of food security as

availability, access, utilization, and stability. Food availability relates to the supply of food through production, distribution, and exchange. Food access refers to the affordability and allocation of food, as well as the preferences of individuals and households. Food utilization refers to the metabolism of food by individuals, as once food is obtained by a household, a variety of factors affect the quantity and quality of food that reaches members of the household. Food stability refers to the ability to obtain food over time. Food insecurity can be transitory, seasonal, or chronic. Here, Food Security has been derived in monetary value for per day per capita. The calculation is done in three steps- Firstly the consumption units are derived from the total population using Singh's Scale of Consumption Unit (which is 0.773 i.e., 1000 person are equal to 773 consumption unit). Secondly, the Net Food Availability is derived from the Total Available Produces (by multiplying it with Coefficient of Production, 0.832. then the Net Food Production is converted in Monetary Valve. And Thirdly, the Net Food Availability in Monetary Value is divided by the consumption units to calculate the per day per capita Food Security/ Insecurity.

Table 3: District Jashpur: Food Security/ Insecurity

Block	Pathalgaon	Pharsabahar	Bagicha	Jashpur	Duldula	Manora	Kunkuri	Kansabel	Average
Food Security (Rs. / capita/day)	38.92	21.75	18.15	14.65	14.48	11.86	8.48	7.78	14.55

Source- Computed by Researcher

The highest Food Security is seen in Pharsabahar block of 38.92 Rupees per capita per day and lowest in Kansabel of 7.78 Rupees per capita per day; while the district's average is 14.55 Rupees per capita per day. The blocks showing higher food security fall in the plateau region which constitutes

the southern half of the district. It has better agrarian conditions and thus better agricultural productivity than their northern counterpart blocks which have dense forest coverage and rough terrain. The highest altitude of 1167 meter is near Manora which is a northern block.

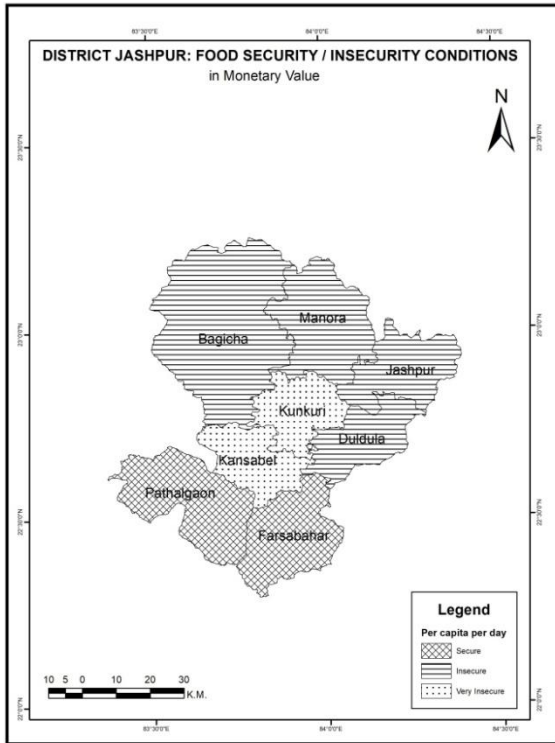


Fig.5

Hunger

Hunger is a condition in which a person, for a sustained period, is unable to eat sufficient food to meet basic nutritional needs. According to the WFP (World Food Programme), "795 million people in the world do not have enough food to lead a healthy active life. That's about one in nine people on earth. The vast majority of the world's hungry people live in developing countries, where 12.9 percent of the population is undernourished." India has a Global Hunger Index (GHI) score of 23.7, which ranks 66th out of 88 countries; in the study conducted by IFPRI (International Food Policy Research Institute) in 2008. This score indicates continued poor performance at reducing hunger in India. While in the 2016 survey of IFPRI, India's Score was 38.5 and it ranked 97th place among 118 countries. Hunger Index is calculated as the sum average of three indicators, they are-

1. Percent of Undernourished Population
2. Percent of underweight children (<5 yrs) and
3. Infant Mortality (<5 yrs)

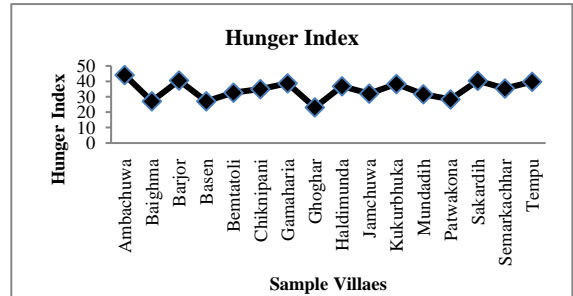


Fig.6

Table 4: District Jashpur: Hunger Index in Sample Villages

S.No.	Sample Village	Hunger Index
1	Ambachuwa	44.2
2	Baighma	27.1
3	Barjor	40.5
4	Basen	27.1
5	Bemtatoli	32.8
6	Chiknipani	34.9
7	Gamaharia	38.7
8	Ghoghar	23.1
9	Haldimunda	36.9
10	Jamchuwa	32.1
11	Kukurbhuka	38.3
12	Mundadih	31.7
13	Patwakona	28.3
14	Sakardih	40.4
15	Semarkachhar	35.5
16	Tempu	39.7

Source- Computed by Researcher

The data for the indicators was collected through the sample schedule survey in the sample villages of Jashpur district. Hunger Index is lowest in sample village Ghoghar (23.1) and highest in Ambachuwa

(44.2). The scale of Hunger Index says that higher the value of Index worse is the situation of hunger; thus the sample villages with higher value have poorer conditions to those of lesser values.

Table 5: Scale of Hunger Index (IFPRI)

Range	≤ 9.9	10.0 to 19.9	20.0 to 34.9	35.0 to 49.9	50.0 ≥
Level	Low	Moderate	Serious	Alarming	Extremely alarming

There are five levels of Hunger Index but all the sample villages fall under Serious and Alarming Zone of hunger. Out of the sixteen sample villages eight fall under Serious Zone. These villages have low level of education and awareness among them about healthcare of pregnant women and infants. The tribal population of the village prefers Jhad-Phuk over medicines. The total irrigated area of Jashpur district is only 3.87% which is lot lower than the irrigated area of Chhattisgarh (28.68%). Lesser irrigational facilities and employment of traditional agrarian practices results in lower agricultural production in the district. This low foodgrain production clearly shows in their food intake habits and nutritional state.

Conclusion and Suggestions

Jashpur district is a backward tribal belt where traditional agriculture is still practiced. The use of modern equipments is rare in sample villages and more than 90 percent of the used agricultural tools are traditional and old. Whereas, the size of land holdings was found to be mostly marginal and small (92%) in the sample villages; large and medium landholdings were only 8 percent. The farmers here practice basic agriculture and most of them do not even grow a second crop. The percent of Irrigated area is only 3.8% in Jashpur district, where it's 28% in Chhattisgarh State. This is the main reason of low production and negligible Rabi crop. This decreased

agricultural production in turn leads to Food Insecurity condition; as the region is dependent on its internal food production.

Hunger Index was found to be between Serious and Alarming in the Sample Villages. High Hunger Index and Low Food Security is seen in the illiterate sample population. Whereas, decrease in Hunger Index with increase in food security and educational status can be clearly seen. Thus, it can be said that increase in Education is related to decrease in Hunger Index. The Public Distribution System is doing a decent job in the region but the supply of items in Ration Shops are irregular and not all the items reaches every part of the district. Government should take measures to ensure that different Food Security Programmes like PDS, TPDS, Mid-Day Meal, etc are contemplated and carried out efficiently; especially in remote tribal areas.

The NAREGA programmes which provide the employment opportunity to most of the landless villagers should be taken seriously and checks should be made to ensure to see that it benefits its target population. High malnutrition was found in children and women of the Sample Village. Economic development is not the single factor in Poverty eradication. But along with Integrated Economic Development, Agricultural Development, Health Reforms, Women and Child Nutrition, etc also play an important role; thus separate programmes should be coordinated for each of these for Poverty Eradication. Efforts should be made to conserve rain water in reservoirs and tanks to facilitate off-season irrigation and care should be taken for the distribution of HYVs, Chemical Fertilizers, Pesticides and Irrigational Facilities in the region, so that its available even in remote areas.

Jashpur district excels in the production vegetable and fruits; especially Potato and Tomato in lower part of the district and Litchi and Pear in upper

region. The emergence of Tea Plantation in Sanna-Pat region has opened the doors of agro-based industries in the district. Measures should be taken for more industries like sauce, chips, and fruit juices to be developed in the district which can provide employment opportunities to the native tribals.

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